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Characterizing Family Physicians Who Refer to Telepsychiatry in Ontario

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Abstract:	Objectives: Telepsychiatry can improve access to psychiatric services for those who otherwise cannot easily access care. Family physicians are gatekeepers to specialized care in Ontario, so it is essential to understand predictors relating to referrals to telepsychiatry to better plan services and increase telepsychiatry adoption. Methods: This study used an annual retrospective cross-sectional study design to compare physicians who referred their patients to telepsychiatry each year from fiscal year (FY) 2008 to FY 2016. A one year (FY 2016) comparison of family physicians who referred to telepsychiatry compared to family physicians who did not refer to telepsychiatry matched (1:2) by region was also conducted. Finally, we used statistical modelling to understand the predictors of referring to telepsychiatry among physicians. Results: Between FY 2008 to FY 2016, telepsychiatry visits increased from 925 visits to 13,825 visits. Thirty-two percent of Ontario primary care physicians referred to telepsychiatry in 2017. Several characteristics were notably different between family physicians who refer to telepsychiatry (FPTs) and family physicians who do not refer to telepsychiatry (FPNTs): FPTs were more likely to be from a residence with less than 10,000 people, to have more nurse practitioners in the

	practice, and to be from a family health team than FPNTs. Rostered patients of FPTs were more likely to reside in rural areas, have more clinical complexity, and to utilize more mental health services compared to FPNTs. Conclusions: There has been an increase in the use of telepsychiatry by patients and family physicians over the study period and family physicians that are live in a rural area, are part of a FHT, have more NPs, with more patients in rural areas with high needs for mental health services are more likely to refer to telepsychiatry.

CHARACTERIZING FAMILY PHYSICIANS WHO REFER TO TELEPSYCHIATRY IN ONTARIO

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Abstract

Introduction

Telepsychiatry can improve access to psychiatric services for those who otherwise cannot easily access care. Family physicians are gatekeepers to specialized care in Ontario, so it is essential to understand predictors relating to referrals to telepsychiatry to better plan services and increase telepsychiatry adoption.

Methods

This study used an annual retrospective cross-sectional study design to compare physicians who referred their patients to telepsychiatry each year from fiscal year (FY) 2008 to FY 2016. A one year (FY 2016) comparison of family physicians who referred to telepsychiatry compared to family physicians who did not refer to telepsychiatry matched (1:2) by region was also conducted. Finally, we used statistical modelling to understand the predictors of referring to telepsychiatry among physicians.

Results

Between FY 2008 to FY 2016, telepsychiatry visits increased from 925 visits to 13,825 visits. Thirty-two percent of Ontario primary care physicians referred to telepsychiatry in 2017. Several characteristics were notably different between family physicians who refer to telepsychiatry (FPTs) and family physicians who do not refer to telepsychiatry (FPNTs): FPTs were more likely to be from a residence with less than 10,000 people, to have more nurse practitioners in the practice, and to be from a family health team than

FPNTs. Rostered patients of FPTs were more likely to reside in rural areas, have more clinical complexity, and to utilize more mental health services compared to FPNTs.

Conclusion

There has been an increase in the use of telepsychiatry by patients and family physicians over the study period, although there remains opportunity for significant growth. Family physicians that live in rural areas, are part of a FHT, have more NPs, with more rural and complex patients were more likely to refer to telepsychiatry. As recent pro-telemedicine policies support the growth of telepsychiatry, this study will serve as an important baseline.

Introduction

Mental illness is among the world's leading causes of sickness and disability; one in five Canadians (two million Ontarians) and one in four people internationally will experience mental illness or addiction.[1-3] However, only one-third of Ontario patients reported having their mental health needs met or partially met within primary care.[1] Patients from lower-income countries and socially disadvantaged groups had lower rates of mental health service utilization.[4-6] Access to quality mental health services is often limited due to rurality, physician shortages and variation in the availability of mental health services.[1,5,7-10]

Telepsychiatry, the delivery of psychiatry via secure videoconferencing, can reduce access barriers such as distance, cost of travel, weather, and workforce shortages.[11-17] In particular, telepsychiatry can provide access to patients who otherwise are not able to easily access services, potentially reducing unnecessary hospitalizations and ED visits.[18,19] Several studies have deemed telepsychiatry effective for various mental health conditions and populations.[20-24] Telemedicine has been shown to reduce isolation and increase the morale of rural primary care practitioners.[25,26] While there is significant potential for telepsychiatry to connect patients to psychiatrists throughout Ontario, recent evidence has shown minimal adoption by patients.[27] In Ontario during the time of this study, in order to deliver and bill for telepsychiatry, psychiatrists were typically required to use a centralized government funded telemedicine platform and patients were typically required to access their telepsychiatry visit at a patient host site

(a clinical site that connects to the centralized provincial network). It is important to note that at the time this paper was submitted temporary policy changes to virtual care as a result of Covid-19 (introduced March 2020) have created more options for home-based care for patients, and have allowed physicians to deliver virtual care via a variety of virtual platforms. These recent changes will be discussed in relation to study findings in the discussion section.

Family physicians are the gatekeepers to specialist care in Canada and other parts of the world.[28,29] Common reasons for family physician referral to psychiatry include obtaining medication recommendations, obtaining second opinions, or non-pharmacological treatment recommendations.[30] Evidence shows providers who are more isolated had more positive feelings about telemedicine.[25] Positive perceptions of telemedicine included convenience, perceived patient benefits, reduced wait time, cost-effectiveness, and access to medical expertise, while negative aspects included cost, reduced funding for in-person services, inconvenience, inadequate reimbursement and training, medical liability, and physician fear of practice change.[25,31-34] Previous studies suggest nurses may be more enthusiastic about telemedicine than physicians, referring physicians tend to be more satisfied than specialists, satisfaction increases relative to use and time, and that providers do not recommend telemedicine in all circumstances.[29,35,36] The objective of this study was to examine the characteristics of family physicians in Ontario who have referred patients to telepsychiatry (FPTs) compared to family physicians who have not referred to telepsychiatry (FPNTs) from FY

2008 to FY 2016, in order to understand if there are specific factors that make certain family physicians more likely to refer than others.

Methods

Setting and Study Design

We conducted an annual retrospective cross-sectional study assessing descriptive characteristics of FPTs for FYs (2008 to 2016); this time horizon was used because it includes data from when the Ontario Health Insurance Plan (OHIP) physician fee schedule telemedicine codes were introduced until the most recent data available from ICES. Referring physician and patient information were ascertained using the OHIP claims database; if referral information was not available, we looked back within the past 12 months to identify the most frequently seen family physician and, if not available, the most recently seen family physician. These data were linked to population-level health administrative databases held at ICES. Additionally, a one year (FY2016) comparison of FPTs vs FPNTs matched (1:2) by the 14 Local Health Integration Networks (LHIN). LHINs are artificially divided regions of Ontario which were designed to support local approaches to strategic planning, funding and regional coordination of clinical care, and are used in administrative data to classify provincial regions. This study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto.

Data Sources

This study used province-wide health administrative databases that were linked using unique encoded identifiers and analyzed at ICES. OHIP data were used to collect family physician details, including physician number, fee code, service date, and location of service provided, and patient information, including patient ID, diagnosis, service date, and location. The National Ambulatory Care Reporting System was used to collect data on emergency department visits. The Ontario Mental Health Reporting System was used to obtain information on psychiatric hospitalizations. The ICES Physician Database and the Primary Care Population database were used to analyze data on primary care providers and teams, including the number of years since medical school graduation, years of practice since graduation, provider type, interprofessional team details, and total physicians per practice. The Client Agency Program Enrolment database was used to analyze data on physician practice type (defined as patient enrollment type). The Ontario Census Area Profiles and the Registered Persons Database were used to analyze patient-level demographic variables (such as age, sex, the region of residence), as well as geographic details (rurality, income quintiles). Primary care providers who had missing age or sex data, and patients with missing health card numbers, missing age or missing sex were excluded from the analysis.

Provider Characteristics

We selected primary care provider characteristics based on two things: availability within the ICES dataset, and previous literature within the field that assessed predictors

using these measures.[34] The primary care provider characteristics used to compare FPTs vs FPNTs included age group, sex, number of years since medical school graduation, years of practice since graduation, rurality of residence, physician practice type (Family Health Team[1] or other), average number of nurse practitioners within the practice, and average number of social workers within the practice.

Patient Characteristics

We examined patient demographic and service utilization characteristics for patients rostered within each physician group (FPT vs FPNT). Patient demographic characteristics included age, sex, neighbourhood income quintile (NIQ) (NIQ 1= 0-20%, NIQ 2= 20-40%, NIQ 3= 40-60%, NIQ 4= 60-80%, NIQ 5= 80%+), and whether they live in a rural or urban area. Patient utilization and medical complexity were considered within each annual cross-section by assessing: number of primary care provider visits (total, mental health and non-mental health); number of emergency department visits (total, mental health and non-mental health-related); number of hospitalizations (total, mental health and non-mental health-related); and comorbidities using the Johns Hopkins' Aggregated Diagnosis Groups (ADG). Mental health primary care visits were defined using a validated algorithm to identify adults accessing care for a mental health disorder, which included adult mental health diagnostic codes 295-298, 300-304, 306, 309, 311, 897-902, 904, 905 (which represents a broad range of adult mental health

[1] Family health teams are different from many primary care practices because they are funded to include an interprofessional team within the practice, and are also paid via a blended capitation model (where physicians are paid primarily through capitation fees based on a defined basket of services delivered to enrolled patients) or a salary model).[163]

and addiction diagnoses as defined by the International Classification of Diseases 10 (ICD-10-CA)).[37] Hospitalizations and ED visits included ICD-10-CA codes F04-F99 (which excludes dementia). The Johns Hopkins ADG's are categorized based on five clinical dimensions, including the duration, the severity, the etiology, the diagnostic certainty and the specialty care involvement of the condition.[38]

Analysis

Descriptive Analysis

Annual Outputs and Trends over Time

Annual panels containing physician and patient characteristics were described, including counts, column percentages, and means with standard deviations. Additionally, changes over time were evaluated for each of the physician characteristics.

Matched Physician Comparison

Matched comparisons between FTPs and FTNPs were presented as counts, column percentages, and standardized mean differences (SMD). We compared between-group differences using the standard mean difference (SMD). Cohen (1988) suggests a small effect size is equal to 0.2 SMD, but recent studies suggest that a more prudent threshold for assessing effect size is 0.1 SMD, especially with large data sets.[39,40] Using this threshold (0.1 SMD), this study identifies significant differences between groups.

The model covariates included physician age (categorical; <34, 35-44, 45-54, 55-64, 64+), sex (Male/Female), number of years after graduation (categorical; 1-10, 11-20,

21-30, 31-40, 41+ years), rural residence (living in community with less than 10,000 people- Yes/No), total nurse practitioner on the team (continuous), total social workers on the team (continuous), if the family physician is a Canadian Medical Graduate (Yes/No), the physician practice type (FHT/Other), patient age (categorical; 0-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81+ years), patient sex (Male/Female), patient NIQ (categorical; 1-5), if the FP has more patients in low NIQ areas (Yes/No), patient residence (Urban/Rural), if the FP has more urban patients than rural (Yes/No), if the FP has more patients with at least one psychosocial ADG (Yes/No), patient region (categorical; LHIN1-14), total number of ED visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+), total number of mental health ED visits (categorical;0-3, 4-9, 10-19, 20+ visits), total hospitalizations (categorical; 0, 1-2, 3-5, 6-10, 11+), total mental health hospitalizations (categorical; 0, 1-2, 3-5, 6-10, 11+), total primary care visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+) and total mental health primary care provider visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+).

Statistical Analysis

We used statistical modeling to understand the predictors of referring to telepsychiatry among physicians. We used GEE for the statistical model, as it accounts for patient clustering at the provider level.[41] All analyses were carried out using SAS version 9.4 (SAS Institute, Cary, NC). All results were presented as adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs).

Results

Descriptive analysis of FTPs

In FY 2016, there were 13,290 family physicians in Ontario; this analysis includes a subset of those family physicians who have referred to telepsychiatry.[42]

Increase in Patients Accessing and Family Physicians Referring to Telepsychiatry

The number of patients receiving telepsychiatry increased from 925 patients in FY 2008 to 13,825 patients in FY 2016, which represents approximately a fifteen-fold increase (see Table 1). There was substantial growth in the number of FPTs from 474 to 4,224, which represents a nine-fold increase from FY 2008 to FY 2016 (see Table 1). Of all physicians in Ontario, 32% referred to telepsychiatry in FY 2016 (4224/13290). Less than 1% of total patients rostered to FPTs had a telepsychiatry visit in FY 2018 (n= 12,449/3,513,638). [Insert Figure 1]

Physician Rurality

In FY 2008, the percentage of total telepsychiatry visits was highest in the North East LHIN (20%, n = 94), followed by the North West LHIN (16%, n = 74) (Ontario's most northern regions), followed by the South West LHIN (15%, n = 70). In FY 2016, those numbers shifted so the highest percentage of telepsychiatry referrals came from family physicians in regions such as Hamilton Niagara Haldimand Brant (10%, n = 433), Central East (10%, n = 421), and Toronto Central (10%, n = 420) LHINs, with the Central (n = 393) and North East (n = 379) LHIN's family physicians referring 9% each. All LHINs ranged between 4-10% of total telepsychiatry delivery in FY 2016, compared

to FY 2008, where the range spread from 0% (in Mississauga Halton LHIN) to 20% (in the North East LHIN). This shows a more evenly distributed adoption of telepsychiatry from \northern regions to all regions of Ontario, many of which still have highly rural and remote communities. [Insert Figure 2]

Comparative Analysis

Family Physician Characteristics

A larger percentage of FPTs were male, compared to FPNTs (59.6% (n = 2427) vs. 53.1% (n = 4075), SD = 0.13). A greater percentage of FPTs were from communities with a population that had less than 10,000 people (14.9% (n = 608) vs. 8.2% (n = 633), SMD = 0.21). FPTs had a larger mean number of nurse practitioners and FPNTs (1.71 (+/- 4.02) vs. 1.10 (+/- 3.70), SMD =0.16), finally, a greater percentage of FPTs belonged to FHTs than FPNTs (28.1% (n = 1145) vs. 18% (n = 1381), SMD = 0.24). [Insert Table 1]

Comparing Patient Roster Characteristics

There were a few notable differences in patient roster characteristics between FPTs and FPNTs. FPTs had a larger mean number of attached patients than FPNTs (862.45 (+/- 668.36) vs. 788.97 (+/- 605.70), SMD = 0.15). A greater percentage of FPTs had patients on their roster from lower NIQ's than FPNTs (1-3) (77.7% (n = 3167) vs. 69.8% (n = 5353), SMD = 0.18). FPTs had a larger mean number of patients from a rural

residence compared to FPNTs (139.28 (+/- 256.05) vs. 54.93 (+/- 137.27), SMD = 0.41). A greater percentage of FPTs had more patients from rural areas than urban areas (14.6% (N = 594) vs. 6.8% (n = 522), SMD = 0.25). FPNTs had a higher patient mean in the Champlain LHIN (which includes Ottawa, a large urban region in Ontario) (FPT = 61.94 (+/- 236.36), FPTN = 99.43 (+/-287.94), SMD = 0.14). FPTs had higher patient means in four LHINs (mostly northern regions): South East (SE) LHIN (FPT = 47.03 (+/- 209), FPTN = 24.27 (+/-132.92), SMD = 0.13), North Simcoe Muskoka (NSM) LHIN (FPT = 59.28 (+/- 230.38), FPNT = 15.12 (+/- 97.56), SMD =0.25), North East (NE) LHIN (FPT = 53.59 (+/- 228.57), FPNT = 19.86 (+/- 124.20), SMD =0.18), North West (NW) LHIN (FPT = 24.64 (+/- 149.32), FPNT = 6.06 (+/- 101.30), SMD = 0.16).

The mean number of patients with psychosocial ADG's was higher for FPTs compared to FPNTs (258.24 (+/- 204.4) vs. 217.56 (+/- 179.29), SMD = 0.21).The mean mental health primary care provider (MHPCP) visits was higher in FPTs compared to FPNTs (707.60 (+/- 2863.95) vs. 276.86 (+/- 532.56), SMD = 0.21). Due to the large standard deviation, we also examined the median for MHPCP; FPTs had a higher median MHPCP visits than FPNTs (229 (IQR=106-415) vs. 189 (IQR=110-350), SMD = 0.24). FPTs have a higher percentage of patients with 415+ MHPCP visits compared to FPNTs (25.2% (n = 1026) vs. 16.7% (n = 1285), SMD 0.21).

The mean number of ED visits was higher for FPTs compared to FPTNs (440.82 (+/- 357.7) vs. 291.96 (+/- 240.01), SMD = 0.49). Table 1 describes the difference between all categories, but the most notable differences are for patients that had 60-156, 157-

257, and 415+ visits. FPTs had a lower percentage of patients with 60-156 ED visits than FPNTs (9.5% (n = 387) vs. 17.2% (n = 1320), SMD = 0.23) and patients with 157-257 visits (12.0% (n = 489) vs. 19.5% (n = 1495), SMD = 0.21). FPTs has a greater percentage of patients with 415+ ED visits compared to FPNTs (45.6% (n = 1857) vs. 16.7% (n = 1285), SMD = 0.48).

FPTs had a larger mean number of MHED visits for rostered patients compared to FPNTs (18.99 (+/- 29.07) vs. 10.91 (+/- 13.07), SMD = 0.36). Full details within each category are in Table 1, but the most notable difference was the group that had 0-3 and 20+ MHED visits. FPTs had a lower percentage of patients with 0-3 MHED visits than FPNTs (16.7% (n = 681) vs. 27.5% (n = 2108), SMD = 0.26) and a higher percentage of patients with 20+ MHED visits than FPNTs (30.9% (n = 1258) vs. 14.1% (n = 1084), SMD = 0.41).

FPTs had a greater mean of hospitalizations compared to FPNTs (57.05 (+/-47.43) vs. 10.91 (+/-13.07), SMD = 0.36). Full details within each category are in Table 1, but the most notable difference was that FPTs had a larger percentage of patients with 11+ hospitalizations, compared to FPNTs (85.7% (n = 3491) vs. 78.8% (n = 6044), SMD = 0.18). Of those hospitalizations, mental health specific hospitalizations (MHH) were measured. FPTs had a greater mean of MHH visits compared to FPNTs (7.01 (+/-13.61) vs. 3.86 (+/-5.43), SMD = 0.36). The most striking differences were the groups that had zero visits and those with 11+ visits. FPTs had a lower percentage of patients with zero MHH visits compared to FPNTs (13.4% (n = 545) vs. 21.9% (n = 1679), SMD = 0.22).

FPTs had a higher percentage of patients with 11+ MHH visits compared to FPNTs (17.8% (n = 725) vs. 6.8% (n = 518), SMD = 0.34).

Statistical Modeling

Regression using Generalized Estimating Equations

A full description of the findings is listed in Table 2. Within this model, a number of significant correlates of FPTs were identified, including physician age group of 55-64 (OR=0.85, CI=00.74-0.97), physician age group of 64+ (OR=0.85, CI=0.62-0.85), and FPTs were more likely to be located in rural areas (OR=1.38, CI=1.17-1.62). Compared to patient rosters of FPNTs, FPT rostered patients were: almost half as likely to be urban (OR=0.55, CI=0.43-.70), more likely to have psychiatric ADGs (OR=1.2, CI=0.86-1.66), and more likely to have 4-9 mental health ED (MHED) visits (OR=1.33, CI=1.03-1.72), patients with 10-19 MHED visits (OR=1.54 CI=1.14-2.07), patients with 20+ MHED visits (OR=2.17, CI=1.60-2.94), patients with 3-5 MHH (OR=1.21, CI=1.08-1.35), patients with 6-10 MHH (OR=1.32, CI=1.15-1.51), patients with 11+ MHH (OR=1.77, CI=1.28-2.43), patients with 157-257 mental health primary care (MHPC) visits (OR=1.24, CI=1.00-1.54), patients with 258-414 MHPC visits (OR=1.38 CI=1.09-1.76), patients with 415+ MHPC visits (OR=1.61, CI=01.33-1.94). [Insert Table 2].

Discussion

To our knowledge, this is the first study that investigates trends and predictors of family physicians referring to telepsychiatry at a system-level. Between FY 2008 and FY 2016,

there was a 9-fold increase in the number of primary care physicians referring to telepsychiatry and a nearly 15-fold increase in the number of primary care patients referred to telepsychiatry. 32% of family physicians referred to telepsychiatry, while less than 1% of patients rostered to FPTs utilized telepsychiatry. While patient adoption of telepsychiatry continued to increase in Ontario during the study period, it still represents a very small percentage of patients in Ontario. These visits represent, for the most part, patients that were required to go to a healthcare site to access care and psychiatrists that are required to use the provincial telemedicine platform. It is evident that there remains a large opportunity to increase patient adoption. As discussed in the introduction, it is likely that the recent Covid-19 related temporary policy changes to virtual care will present an opportunity for significant growth and adoption of telepsychiatry. This study provides an essential benchmark for future analyses, comparing how these policy changes have shifted adoption patterns with patients and family physician referrals.

Physicians who referred to telepsychiatry in FY 2008 were mainly from northern regions, whereas in FY 2016, more referrals from southern regions emerged, many of which still have rural areas within their catchments. Referral to telepsychiatry was more evenly distributed throughout the province in FY 2016. While historically telepsychiatry was used to support rural populations, in later years of the study, there were increasing provincially funded telepsychiatry projects that aimed to increase adoption of telepsychiatry within more populous regions. While it is important to create access and choice for patients in both rural and urban areas, policy-makers and funders should

consider aspects of digital health equity[43], allowing the use of diverse secure virtual platforms, funding home-based visits and establishing mechanisms to support the appropriate distribution of virtual care throughout the province.

Past studies have suggested that physicians who were more isolated and were part of an integrated health system had positive feelings about telemedicine, and that nurses were more enthusiastic about telemedicine than physicians.[25,36] As such, unsurprisingly, this study found that predictors of family physician referrals to telepsychiatry include rurality of residence (for both provider and patient), team-based practice models, nurse practitioners on the team, and clinical complexity of patient rosters.

This study has numerous strengths; it utilizes a large, multi-year, linked dataset of family physician and patient data to help understand important characteristics that are common in physicians who refer to telepsychiatry. Additionally, since this study uses administrative data, the study was conducted rapidly using a retrospective analysis. However, the study also has several limitations. The identification of telepsychiatry visits is contingent upon psychiatrists using telepsychiatry billing codes and billing fee for service, so it is possible that there is missing data, or an underrepresentation of visits completed by physicians paid by salary or alternate funding. Another potential limitation, is that while this study includes nurse practitioners as a covariate in the analysis, it does not take into account actual nurse practitioner referrals to telepsychiatry, which could lead to an underestimate of our total telepsychiatry visits. We believe, however, that this will have minimal impact on our study because it is likely

that nurse practitioner referrals will be captured within total telepsychiatry visits, but rostered (as defined in our methods) to a family physician instead.

Conclusion

While telepsychiatry has seen continued growth over recent years, there remains significant opportunities for increased adoption. This study shows that certain factors, including rurality, provider practice type, the number of nurse practitioners on the provider's team, as well as patient healthcare and hospital utilization characteristics are more likely in FPTs than FPNTs. This study provides a baseline from which to assess recent rapid mobilization of telepsychiatry, and a means of doing so using administrative health data.

Tables and Figures

Figure 1. Telepsychiatry Adoption by Year (FY2008 and FY2016)

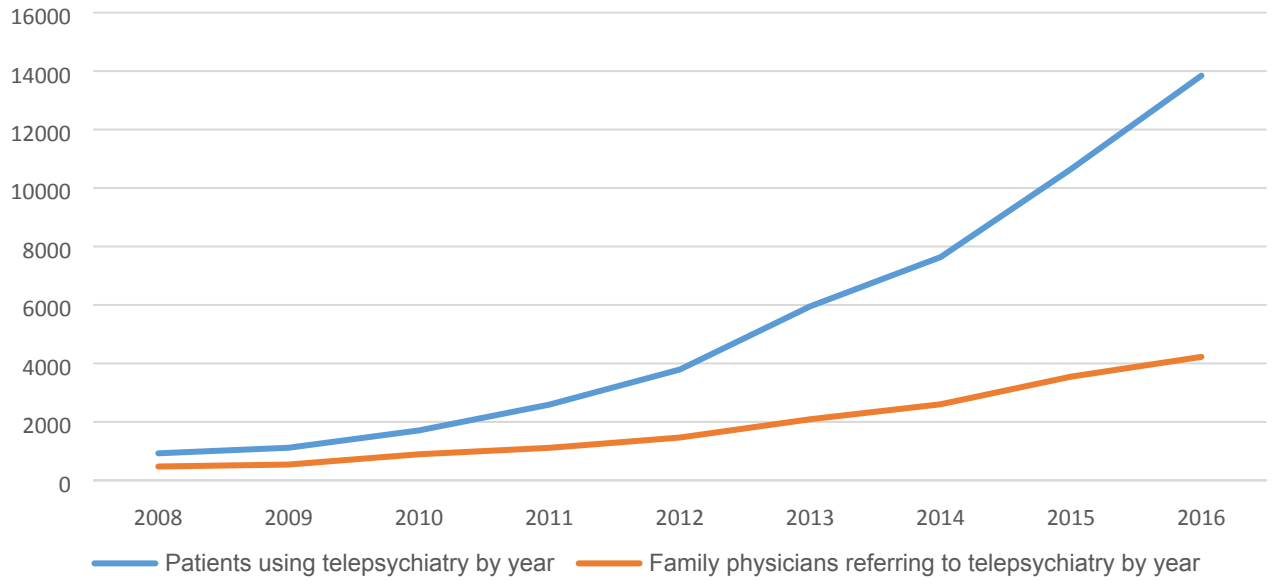

Figure 2. Percentage of Referring Physicians by Region (2008 and 2016)

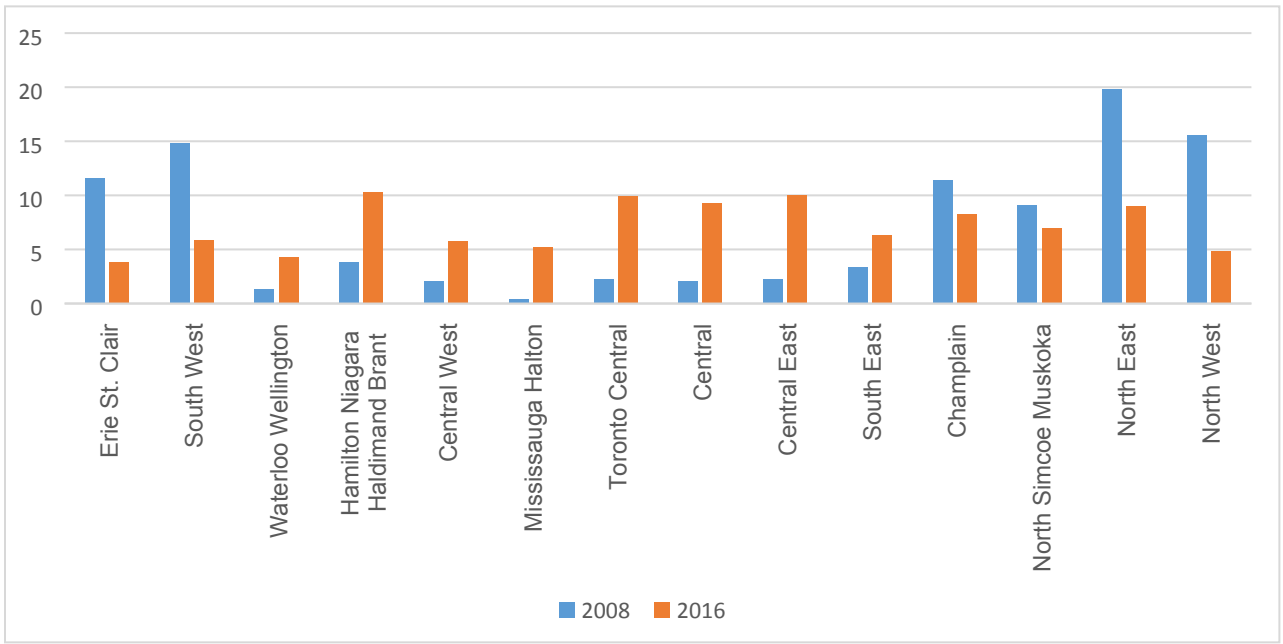

Table **1**. Comparative Analysis of Family Physicians that Refer to Telepsychiatry compared to (2016)

VARIABLE	VALUE	FPT	FPNT	TOTAL	SMD
		N = 4,074	N = 7,674	N = 11,748	
PHYSICIAN CHARACTERISTICS					
Physician Sex	F	1,647 (40.4%)	3,599 (46.9%)	5,246 (44.7%)	0.13
	M	2,427 (59.6%)	4,075 (53.1%)	6,502 (55.3%)	0.13
< 10,000 population in CMA	N	3,466 (85.1%)	7,041 (91.8%)	10,507 (89.4%)	0.21
	Y	608 (14.9%)	633 (8.2%)	1,241 (10.6%)	0.21
Nurse Practitioners on Team	Mean ± SD	1.71 ± 4.02	1.10 ± 3.70	1.31 ± 3.83	0.16
Physician Practice Type	FHT	1,145 (28.1%)	1,381 (18.0%)	2,526 (21.5%)	0.24
	Others	2,929 (71.9%)	6,293 (82.0%)	9,222 (78.5%)	0.24
PATIENT ROSTER CHARACTERISTICS					
Total # of attached patients	Mean ± SD	862.45 ± 668.36	766.97 ± 605.70	800.64 ± 630.13	0.15
# patients in NIQ 1,2&3 > # patients in NIQ 4&5	No	907 (22.3%)	2,127 (27.7%)	3,034 (25.8%)	0.13
	Yes	3,167 (77.7%)	5,353 (69.8%)	8,520 (72.5%)	0.18
Rural Residence	Mean ± SD	139.28 ± 256.05	54.93 ± 137.27	84.67 ± 192.19	0.41
# of patients in urban residence > # of patients in rural residence	No	594 (14.6%)	522 (6.8%)	1,116 (9.5%)	0.25
	Yes	3,480 (85.4%)	6,958 (90.7%)	10,438 (88.8%)	0.16
South East LHIN	Mean ± SD	47.03 ± 209.09	24.27 ± 132.92	32.29 ± 164.22	0.13
Champlain LHIN	Mean ± SD	61.94 ± 263.36	99.43 ± 287.94	86.21 ± 280.09	0.14
North Simcoe Muskoka LHIN	Mean ± SD	59.28 ± 230.38	15.12 ± 97.56	30.69 ± 159.11	0.25
North East LHIN	Mean ± SD	53.59 ± 228.57	19.86 ± 124.20	31.75 ± 169.31	0.18
North West LHIN	Mean ± SD	24.64 ± 149.32	6.06 ± 59.90	12.61 ± 101.30	0.16
# of patients with a psychosocial ADG	Mean ± SD	258.24 ± 204.40	217.56 ± 179.29	231.91 ± 189.52	0.21
Total MH PCP visits	Mean ± SD	707.60 ± 2,863.95	276.86 ± 532.56	428.74 ± 1,765.68	0.21
	Median (IQR)	239 (106-415)	188 (73-335)	204 (82-364)	0.24
	00-59	686 (16.8%)	1,626 (21.2%)	2,312 (19.7%)	0.11
	60-156	702 (17.2%)	1,612 (21.0%)	2,314 (19.7%)	0.1
	157-257	795 (19.5%)	1,512 (19.7%)	2,307 (19.6%)	0

	258-414	865 (21.2%)	1,445 (18.8%)	2,310 (19.7%)	0.06
	415-high	1,026 (25.2%)	1,285 (16.7%)	2,311 (19.7%)	0.21
VARIABLE	**VALUE**	**FPT**	**FPNT**	**TOTAL**	**SMD**
Total ED visits	Mean ± SD	440.82 ± 357.70	291.96 ± 240.01	344.45 ± 295.74	0.49
	00-59	493 (12.1%)	1,090 (14.2%)	1,583 (13.5%)	0.06
	60-156	387 (9.5%)	1,320 (17.2%)	1,707 (14.5%)	0.23
	157-257	489 (12.0%)	1,495 (19.5%)	1,984 (16.9%)	0.21
	258-414	848 (20.8%)	1,782 (23.2%)	2,630 (22.4%)	0.06
	415-high	1,857 (45.6%)	1,793 (23.4%)	3,650 (31.1%)	0.48
Total MH ED visits	Mean ± SD	18.99 ± 29.07	10.91 ± 13.07	13.75 ± 20.58	0.36
	00-03	681 (16.7%)	2,108 (27.5%)	2,789 (23.7%)	0.26
	04-09	922 (22.6%)	2,275 (29.6%)	3,197 (27.2%)	0.16
	10-19	1,213 (29.8%)	2,013 (26.2%)	3,226 (27.5%)	0.08
	20-high	1,258 (30.9%)	1,084 (14.1%)	2,342 (19.9%)	0.41
Total hospitalizations	Mean ± SD	57.05 ± 47.43	41.75 ± 36.01	47.15 ± 41.06	0.36
	0 visits	116 (2.8%)	286 (3.7%)	402 (3.4%)	0.05
	01-02 visit	133 (3.3%)	287 (3.7%)	420 (3.6%)	0.03
	03-05 visits	131 (3.2%)	374 (4.9%)	505 (4.3%)	0.08
	06-10 visits	203 (5.0%)	489 (6.4%)	692 (5.9%)	0.06
	11+ visits	3,491 (85.7%)	6,044 (78.8%)	9,535 (81.2%)	0.18
Total MH hospitalizations	Mean ± SD	7.01 ± 13.61	3.86 ± 5.43	4.97 ± 9.31	0.3
	0 visits	545 (13.4%)	1,679 (21.9%)	2,224 (18.9%)	0.22
	01-02 visit	768 (18.9%)	2,078 (27.1%)	2,846 (24.2%)	0.2
	03-05 visits	1,072 (26.3%)	1,959 (25.5%)	3,031 (25.8%)	0.02
	06-10 visits	964 (23.7%)	1,246 (16.2%)	2,210 (18.8%)	0.19
	11+ visits	725 (17.8%)	518 (6.8%)	1,243 (10.6%)	0.34

NIQ= Neighbourhood Income Quintiles
LHIN=Local Health Integration Networks
ADG= Aggregated Diagnosis Groupings
MHPCP= Mental Health Primary Care Practitioner
ED= Emergency Department
MH ED= Mental Health Emergency Department
MH= Mental Health

Table 2. Model using Generalized Estimating Equations comparing FPTs vs FPNTs (2016)

Analysis Of GEE Parameter Estimates			
	Estimate	95% Confidence Limits	
Intercept	-0.9162	-1.1901	-0.6423
Physician Age 35-44 vs <=34	0.8895	0.7855	1.0072
Physician Age 45-54 vs <=34	0.9082	0.7983	1.0333
Physician Age 55-64 vs <=34	0.849	0.7419	0.9717
Physician Age 64+ vs <=34	0.7255	0.6223	0.8458
Sex (Male vs Female)	1.0144	0.9368	1.0983
Physician Rural (Yes vs No)	1.3791	1.174	1.6199
Canadian Medical Graduate (Yes vs No)	1.0333	0.9493	1.1247
Canadian Medical Graduate (Unknown vs No)	1.0231	0.8617	1.2148
More patients in low/med income quintile (Yes vs No)	1.0719	0.969	1.1856
More urban patients (Yes vs No)	0.5491	0.4338	0.6952
Mental Health ED Visits (04-09 vs 00-03)	1.3289	1.0252	1.7226
Mental Health ED Visits (10-19 vs 00-03)	1.5373	1.1442	2.0654
Mental Health ED Visits (20-high vs 00-03)	2.1678	1.601	2.9352
Mental Health Hospitalizations (0 visits vs 01-02 visit)	0.9072	0.7363	1.1179
Mental Health Hospitalizations 03-05 visits vs 01-02 visit	1.2048	1.0749	1.3504
Mental Health Hospitalizations 06-10 visits vs 01-02 visit	1.316	1.1496	1.5064
Mental Health Hospitalizations 11+ visits vs 01-02 visit	1.7662	1.2837	2.4301
Mental Health Primary Care Visits (60-156 vs 00-59)	0.965	0.8134	1.1449
Mental Health Primary Care Visits (157-257 vs 00-59)	1.237	0.9943	1.539
Mental Health Primary Care Visits (258-414 vs 00-59)	1.384	1.0859	1.7638
Mental Health Primary Care Visits (415-high vs 00-59)	1.6089	1.3322	1.943
More patients with psychiatric ADGs (Yes vs No)	1.1979	0.8627	1.6634

ED= Emergency Department

ADG= Aggregated Diagnosis Groups

References

1. Brien S, Grenier L, Kapral M. *Taking stock.* Health Quality Ontario; 2015.

2. Bishop TF, Press MJ, Keyhani S, Pincus HA. Acceptance of insurance by psychiatrists and the implications for access to mental health care. *JAMA psychiatry*. 2014;71(2):176-181.

3. World Health Organization. Mental disorders affect one in four people. *World Health Report*. 2001.

4. Alegría M, Nakash O, NeMoyer A. Increasing equity in access to mental health care: A critical first step in improving service quality. *World Psychiatry*. 2018;17(1):43.

5. Wang PS, Aguilar-Gaxiola S, Alonso J, et al. Use of mental health services for anxiety, mood, and substance disorders in 17 countries in the WHO world mental health surveys. *The Lancet*. 2007;370(9590):841-850.

6. Goldner EM, Jones W, Fang ML. Access to and waiting time for psychiatrist services in a canadian urban area: A study in real time. *The Canadian Journal of Psychiatry*. 2011;56(8):474-480.

7. Meadows GN, Enticott JC, Inder B, Russell GM, Gurr R. Better access to mental health care and the failure of the medicare principle of universality. *Med J Aust*. 2015;202(4):190-194.

8. Cunningham PJ. Beyond parity: Primary care physicians' perspectives on access to mental health care: More PCPs have trouble obtaining mental health services for their patients than have problems getting other specialty services. *Health Aff*. 2009;28(Suppl1):w490-w501.

9. Kurdyak P, Zaheer J, Cheng J, Rudoler D, Mulsant BH. Changes in characteristics and practice patterns of ontario psychiatrists: Implications for access to psychiatrists. *The Canadian Journal of Psychiatry*. 2017;62(1):40-47.

10. Kurdyak P, Stukel TA, Goldbloom D, Kopp A, Zagorski BM, Mulsant BH. Universal coverage without universal access: A study of psychiatrist supply and practice patterns in ontario. *Open Medicine*. 2014;8(3):e87.

11. Myers KM, Valentine JM, Melzer SM. Child and adolescent telepsychiatry: Utilization and satisfaction. *Telemedicine and e-Health*. 2008;14(2):131-137.

12. Antonacci DJ, Bloch RM, Saeed SA, Yildirim Y, Talley J. Empirical evidence on the use and effectiveness of telepsychiatry via videoconferencing: Implications for forensic and correctional psychiatry. *Behav Sci Law*. 2008;26(3):253-269.

13. Campbell R, O'Gorman J, Cernovsky ZZ. Reactions of psychiatric patients to telepsychiatry. *Mental illness*. 2015;7(2).

14. Deslich S, Stec B, Tomblin S, Coustasse A. Telepsychiatry in the 21st century: Transforming healthcare with technology. *Perspectives in Health Information*

Management/AHIMA, American Health Information Management Association. 2013;10(Summer).

15. Fleming DA, Edison KE, Pak H. Telehealth ethics. *Telemedicine and e-Health*. 2009;15(8):797-803.

16. Saeed SA, Diamond J, Bloch RM. Use of telepsychiatry to improve care for people with mental illness in rural North Carolina. *NC Med J*. 2011;72(3):219-222.

17. Ulzen T, Williamson L, Foster PP, Parris-Barnes K. The evolution of a community-based telepsychiatry program in rural alabama: Lessons learned—a brief report. *Community Ment Health J*. 2013;49(1):101-105.

18. Lyketsos CG, Roques C, Hovanec L, Jones III BN. Telemedicine use and the reduction of psychiatric admissions from a long-term care facility. *J Geriatr Psychiatry Neurol*. 2001;14(2):76-79.

19. Hilty DM, Ferrer DC, Parish MB, Johnston B, Callahan EJ, Yellowlees PM. The effectiveness of telemental health: A 2013 review. *Telemedicine and e-Health*. 2013;19(6):444-454.

20. Chakrabarti S. Usefulness of telepsychiatry: A critical evaluation of videoconferencing-based approaches. *World journal of psychiatry*. 2015;5(3):286.

21. Bishop JE, O'Reilly RL, Maddox K, Hutchinson LJ. Client satisfaction in a feasibility study comparing face-to-face interviews with telepsychiatry. *J Telemed Telecare*. 2002;8(4):217-221.

22. Frueh BC, Monnier J, Yim E, Grubaugh AL, Hamner MB, Knapp RG. A randomized trial of telepsychiatry for post-traumatic stress disorder. *J Telemed Telecare*. 2007;13(3):142-147.

23. Farabee D, Calhoun S, Veliz R. An experimental comparison of telepsychiatry and conventional psychiatry for parolees. *Psychiatric Services*. 2016;67(5):562-565.

24. Bashshur RL, Shannon GW, Bashshur N, Yellowlees PM. The empirical evidence for telemedicine interventions in mental disorders. *Telemedicine and e-Health*. 2016;22(2):87-113.

25. Sargeant J, Allen M, Langille D. Physician perceptions of the effect of telemedicine on rural retention and recruitment. *J Telemed Telecare*. 2004;10(2):89-93.

26. Swanson B. Information technology and under-served communities. *J Telemed Telecare*. 1999;5(2_suppl):3-10.

27. Serhal E, Crawford A, Cheng J, Kurdyak P. Implementation and utilisation of telepsychiatry in Ontario: A population-based study. *The Canadian Journal of Psychiatry*. 2017;62(10):716-725.

28. Grumbach K, Selby JV, Damberg C, et al. Resolving the gatekeeper conundrum: What patients value in primary care and referrals to specialists. *JAMA*. 1999;282(3):261-266.

29. Norton PG, Dunn EV, Bestvater D. Referrals in primary care: Is the family physician a “Gatekeeper”? *Canadian Family Physician*. 1989;35:1776.

30. Steele M, Zayed R, Davidson B, et al. Referral patterns and training needs in psychiatry among primary care physicians in canadian rural/remote areas. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*. 2012;21(2):111.

31. Spaulding RJ, Russo T, Cook DJ, Doolittle GC. Diffusion theory and telemedicine adoption by kansas health-care providers: Critical factors in telemedicine adoption for improved patient access. *J Telemed Telecare*. 2005;11(1_suppl):107-109.

32. Whitten P, Franken EA. Telemedicine for patient consultation: Factors affecting use by rural primary-care physicians in kansas. *J Telemed Telecare*. 1995;1(3):139-144.

33. LeRouge C, Garfield M. Crossing the telemedicine chasm: Have the US barriers to widespread adoption of telemedicine been significantly reduced? *International journal of environmental research and public health*. 2013;10(12):6472-6484.

34. Moore MA, Coffman M, Jetty A, Klink K, Petterson S, Bazemore A. Family physicians report considerable interest in, but limited use of, telehealth services. *The Journal of the American Board of Family Medicine*. 2017;30(3):320-330.

35. Spaulding R, Cain S, Sonnenschein K. Urban telepsychiatry: Uncommon service for a common need. *Child and Adolescent Psychiatric Clinics*. 2011;20(1):29-39.

36. Whitten PS, Mackert MS. Addressing telehealth's foremost barrier: Provider as initial gatekeeper. *Int J Technol Assess Health Care*. 2005;21(4):517-521.

37. Steele LS, Glazier RH, Lin E, Evans M. Using administrative data to measure ambulatory mental health service provision in primary care. *Med Care*. 2004:960-965.

38. Austin PC, van Walraven C, Wodchis WP, Newman A, Anderson GM. Using the Johns Hopkins aggregated diagnosis groups (ADGs) to predict mortality in a general adult population cohort in Ontario, Canada. *Med Care*. 2011;49(10):932.

39. Cohen J. *Statistical power analysis for the behavioral sciences.* Routledge; 2013.

40. Austin PC. Using the standardized difference to compare the prevalence of a binary variable between two groups in observational research. *Communications in Statistics-Simulation and Computation*. 2009;38(6):1228-1234.

41. Wang M. Generalized estimating equations in longitudinal data analysis: A review and recent developments. *Advances in Statistics*. 2014;2014.

42. The Ontario Physician Human Resources Data Centre. . (2018, 10). Physicians in Ontario 2017. Retrieved from the Ontario Physician Human Resources data centre: Http://Www.ophrdc.org/wp-content/uploads/2018/10/PIO-2017-report-with-hyperlinks.pdf. Mc*Master University*. 2018.

43. Crawford, A., & Serhal, E. (2020). Digital Health Equity and COVID-19: The Innovation Curve Cannot Reinforce the Social Gradient of Health. Journal of Medical Internet Research, 22(6), e19361.

Characterizing Family Physicians Who Refer to Telepsychiatry in Ontario

Figure Legends

Figure 1. Telepsychiatry Adoption by Year (FY2008 and FY2016)

Figure 2. Percentage of Referring Physicians by Region (FY 2008 and FY2016)

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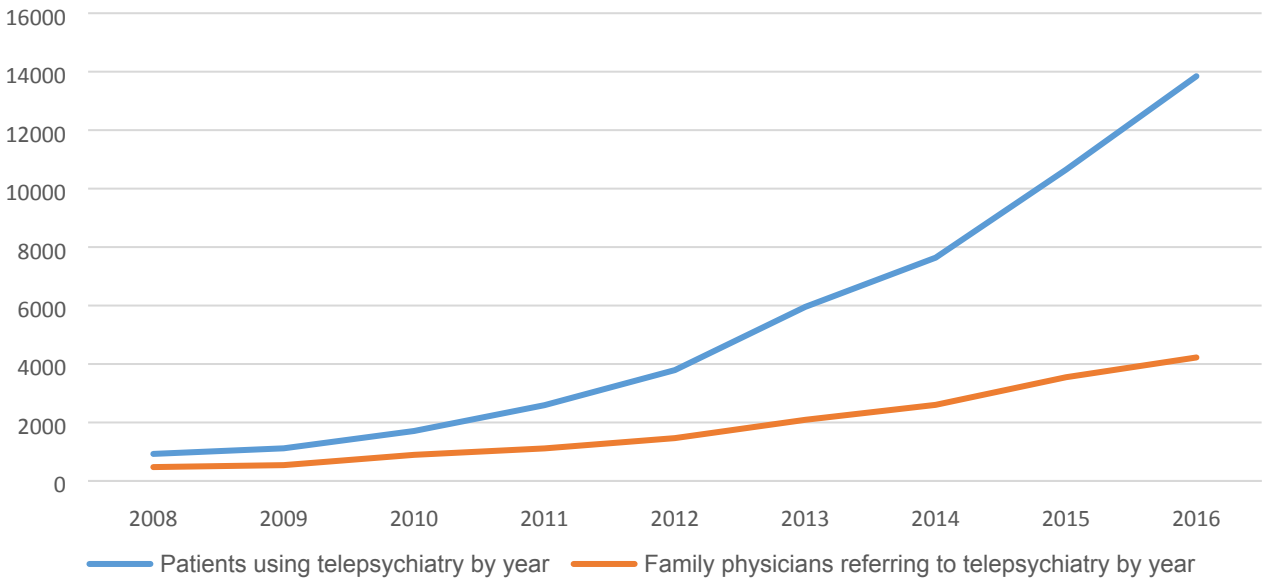

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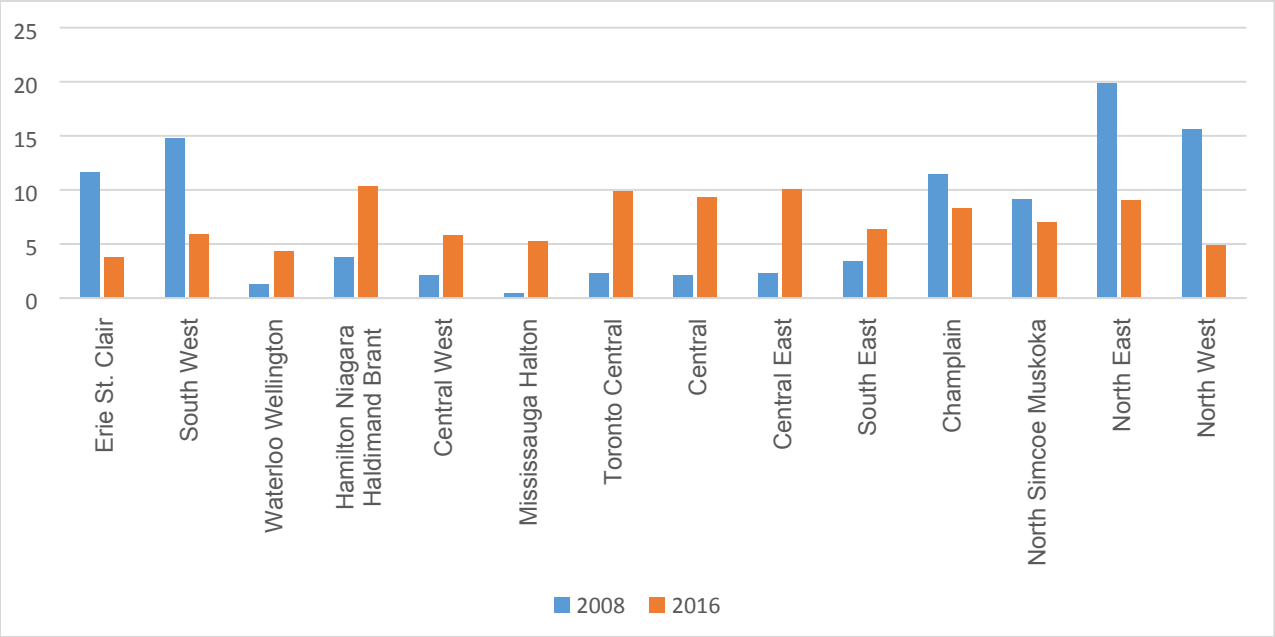

CARACTÉRISATION DES MÉDECINS DE FAMILLE QUI RÉFÈRENT À LA TÉLÉPSYCHIATRIE EN ONTARIO

Introduction : La télépsychiatrie peut améliorer l'accès aux services psychiatriques pour ceux qui autrement ne peuvent accéder aux soins facilement. Les médecins de famille sont les gardiens des soins spécialisés en Ontario, alors il est essentiel de comprendre les prédicteurs en rapport avec les références à la télépsychiatrie pour mieux planifier les services et stimuler l'adoption de la télépsychiatrie.

Méthodes : La présente étude a utilisé une méthodologie d'étude transversale rétrospective annuelle pour comparer les médecins qui référaient leurs patients en télépsychiatrie chaque année de l'exercice financier (EF) de 2008 à l'EF de 2016. Une comparaison d'un an (EF 2016) des médecins de famille qui référaient en télépsychiatrie avec les médecins de famille qui ne référaient pas en télépsychiatrie**,** appariés (1:2) par région**,** a aussi été menée. Enfin, nous avons utilisé une modélisation statistique pour comprendre les prédicteurs de la référence en télépsychiatrie chez les médecins.

Résultats *:* Entre l'EF 2008 et l'EF 2016, les visites en télépsychiatrie sont passées de 925 à 13 825 visites. Trente-deux pour cent des médecins de première ligne en Ontario ont référé à la télépsychiatrie en 2017. Plusieurs caractéristiques étaient notablement différentes entre les médecins de famille qui réfèrent en télépsychiatrie (MFT) et les médecins de famille qui ne réfèrent pas en télépsychiatrie (MFNT) : les MFT étaient plus susceptibles de provenir d'une résidence de moins de 10 000 personnes, d'avoir plus d'infirmières praticiennes (IP) dans leur pratique, et de faire partie d'une équipe de santé familiale (ESF) que les MFNT. Les patients inscrits étaient plus susceptibles de résider en région rurale, de présenter plus de complexité clinique, et d'utiliser plus de services de santé mentale comparativement aux MFNT.

Conclusion : Il y a eu une augmentation de l'utilisation de la télépsychiatrie par les patients et les médecins de famille durant la période de l'étude, bien qu'il demeure une possibilité de croissance significative. Les médecins de famille qui habitent en milieu rural, qui font partie d'une ESF, qui ont plus d'IP, dont les patients sont davantage complexes et en milieu rural étaient plus susceptibles de référer en télépsychiatrie. Comme de récentes politiques en faveur de la télépsychiatrie en soutiennent la croissance, la présente étude servira de base de départ importante*.*

Characterizing Family Physicians Who Refer to Telepsychiatry in Ontario

Figure Legends

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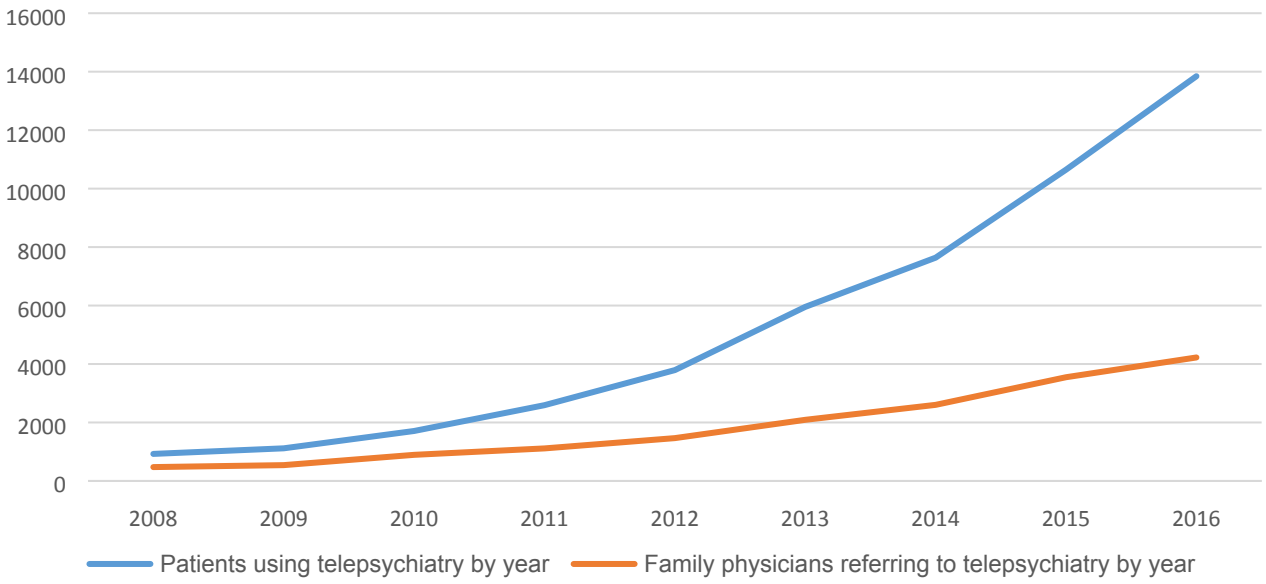

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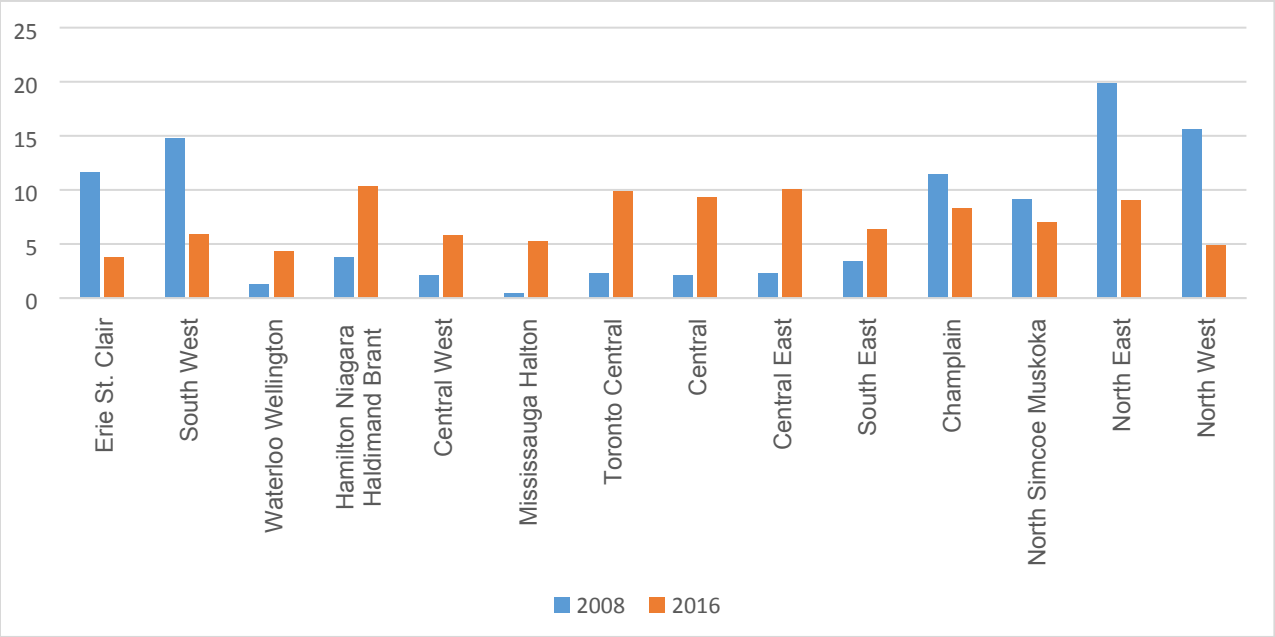

CHARACTERIZING FAMILY PHYSICIANS WHO REFER TO TELEPSYCHIATRY IN ONTARIO

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Abstract

Introduction

Telepsychiatry can improve access to psychiatric services for those who otherwise cannot easily access care. Family physicians are gatekeepers to specialized care in Ontario, so it is essential to understand predictors relating to referrals to telepsychiatry to better plan services and increase telepsychiatry adoption.

Methods

This study used an annual retrospective cross-sectional study design to compare physicians who referred their patients to telepsychiatry each year from fiscal year (FY) 2008 to FY 2016. A one year (FY 2016) comparison of family physicians who referred to telepsychiatry compared to family physicians who did not refer to telepsychiatry matched (1:2) by region was also conducted. Finally, we used statistical modelling to understand the predictors of referring to telepsychiatry among physicians.

Results

Between FY 2008 to FY 2016, telepsychiatry visits increased from 925 visits to 13,825 visits. Thirty-two percent of Ontario primary care physicians referred to telepsychiatry in 2017. Several characteristics were notably different between family physicians who refer to telepsychiatry (FPTs) and family physicians who do not refer to telepsychiatry (FPNTs): FPTs were more likely to be from a residence with less than 10,000 people, to have more nurse practitioners in the practice, and to be from a family health team than

FPNTs. Rostered patients of FPTs were more likely to reside in rural areas, have more clinical complexity, and to utilize more mental health services compared to FPNTs.

Conclusion

There has been an increase in the use of telepsychiatry by patients and family physicians over the study period, although there remains opportunity for significant growth. ~~and family~~Family physicians that ~~are~~ live in ~~a~~ rural areas, are part of a FHT, have more NPs, with more rural and complex patients ~~patients in rural areas with high needs for mental health services are~~ were more likely to refer to telepsychiatry. As recent pro-telemedicine policies support the growth of telepsychiatry, this study will serve as an important baseline.

Introduction

Mental illness is among the world's leading causes of sickness and disability; one in five Canadians (two million Ontarians) and one in four people internationally will experience mental illness or addiction ~~at some point in their life, and one in four people internationally will be affected by a mental or neurological disorder~~.[1-3] However, only one-third of Ontario patients ~~requiring mental health and addiction services~~ reported having their mental health needs met or partially met within primary care.[1] Patients ~~Similar international studies found that at least two thirds of people with common mental disorders do not receive treatment and patients~~ from lower-income countries and socially disadvantaged groups had lower rates of mental health service utilization.[4-6] Access to quality mental health services is ~~limited in many parts of the world, including Canada~~ often limited~~,~~ due to rurality, physician shortages and variation in the availability of mental health services ~~from primary care providers and outpatient psychiatrists~~.[1,5,7-10]

Telepsychiatry, ~~which is~~ the delivery of psychiatry via secure videoconferencing, can reduce access barriers such as distance, cost of travel, weather, and workforce shortages.[11-17] In particular, telepsychiatry can provide access to ~~outpatient psychiatric care for~~ patients who otherwise are not able to easily access services, potentially reducing unnecessary hospitalizations and ED visits.[18,19] Several studies have deemed telepsychiatry effective for various mental health conditions and populations.[20-24] Telemedicine has been shown to reduce isolation and increase the morale of rural primary care practitioners.[25,26] While there is significant potential for telepsychiatry to

connect patients to psychiatrists throughout Ontario, recent evidence has shown minimal adoption by patients.[27] In Ontario during the time of this study, in order to deliver and bill for telepsychiatry, psychiatrists were typically required to use a centralized government funded telemedicine platform ~~the Ontario Telemedicine Network (OTN) platform (a centralized, government funded platform) to deliver care. Additionally, other than small pilot tests,~~and patients were typically required to access their telepsychiatry visit at a patient host site (a clinical site that ~~could connect to the OTN~~ connects to the centralized provincial network). It is important to note that at the time this paper was submitted ~~there were significant~~ temporary policy changes to virtual care as a result of Covid-19 (introduced March 2020)~~, which~~ have created more options for home-based care for patients, and have allowed physicians to deliver virtual care via a variety of virtual platforms. ~~have removed the requirement that physicians must be members of the OTN network, and use the OTN platforms to deliver and bill for virtual care.~~ These recent changes will be discussed in relation to ~~the~~ study findings in the discussion section.

Family physicians are the gatekeepers to specialist care in Canada and other parts of the world.[28,29] Common reasons for family physician referral to psychiatry include obtaining medication recommendations, obtaining second opinions, or ~~for patients who are non-responsive to medications, getting a second opinion on a diagnosis, and obtaining~~ non-pharmacological treatment recommendations.[30] Evidence shows providers who are more isolated had more positive feelings about telemedicine.[25]

Positive perceptions of telemedicine included convenience, perceived patient benefits, reduced wait time, cost-effectiveness, and access to medical expertise~~,~~; while negative aspects included cost, reduced funding for in-person services, inconvenience ~~to doctors~~, inadequate reimbursement~~, inadequate~~ and training, medical liability, ~~issues with referral patterns,~~ and physician fear of practice change.[25,31-34] Previous studies suggest nurses ~~are more~~may be more enthusiastic about telemedicine than physicians, referring physicians ~~are more~~tend to be more satisfied than ~~the referred~~ specialists, satisfaction increases relative to use and time, and that providers do not recommend telemedicine in all circumstances.[29,35,36] ~~Understanding if there are differences in family physicians who refer to telepsychiatry, compared to those who do not, is an important step to understanding how telepsychiatry is currently being used, and how it can be deployed more effectively throughout the province.~~ The objective of this study was to examine the characteristics of family physicians in Ontario who have referred patients to telepsychiatry (FPTs) compared to family physicians who have not referred to telepsychiatry (FPNTs) from FY 2008 to FY 2016, in order to understand if there are specific factors that make certain family physicians more likely to refer than others.

Methods

Setting and Study Design

We conducted an annual retrospective cross-sectional study assessing descriptive characteristics of FPTs for FYs (2008 to 2016); this time horizon was used because it

includes data from when the Ontario Health Insurance Plan (OHIP) physician fee schedule telemedicine codes were introduced until the most recent data available from ICES. Referring physician and patient information were ascertained using the OHIP claims database; if referral information was not available, we looked back within the past 12 months to identify the most frequently seen family physician and, if not available, the most recently seen family physician. These data were linked to population-level health administrative databases held at ICES. Additionally, a one year (FY2016) comparison of FPTs vs FPNTs matched (1:2) by the 14 Local Health Integration Networks ~~(the region in which they work) was conducted~~(LHIN). LHINs are artificially divided regions of Ontario which were designed to support local approaches to strategic planning, funding and regional coordination of clinical care, and are used in administrative data to classify provincial regions. ~~We matched by these 14 LHINs only, and not age or sex because we wanted to ensure we were able to explore differences in age and sex between the groups.~~ This study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto.

Data Sources

This study used province-wide health administrative databases that were linked using unique encoded identifiers and analyzed at ICES. OHIP data were used to collect family physician details, including physician number, fee code, service date, and location of service provided, and patient information, including patient ID, diagnosis, service date, and location. The National Ambulatory Care Reporting System was used to collect data on emergency department visits. The Ontario Mental Health Reporting System was

used to obtain information on psychiatric hospitalizations. The ICES Physician Database and the Primary Care Population database were used to analyze data on primary care providers and teams, including the number of years since medical school graduation, years of practice since graduation, provider type, interprofessional team details, and total physicians per practice. The Client Agency Program Enrolment database was used to analyze data on physician practice type (defined as patient enrollment type). The Ontario Census Area Profiles and the Registered Persons Database were used to analyze patient-level demographic variables (such as age, sex, the region of residence), as well as geographic details (rurality, income quintiles). Primary care providers who had missing age or sex data, and patients with missing health card numbers, missing age or missing sex were excluded from the analysis.

Provider Characteristics

We selected primary care provider characteristics based on two things: availability within the ICES dataset, and previous literature within the field that assessed predictors using these measures.[34] The primary care provider characteristics used to compare FPTs vs FPNTs included age group, sex, number of years since medical school graduation, years of practice since graduation, rurality of residence, physician practice type (Family Health Team[1] or other), average number of nurse practitioners within the practice, and average number of social workers within the practice.

[1] Family health teams are different from many primary care practices because they are funded to include an interprofessional team within the practice, and are also paid via a blended capitation model (where physicians are paid primarily through capitation fees based on a defined basket of services delivered to enrolled patients) or a salary model).[163]

Patient Characteristics

We examined patient demographic and service utilization characteristics for patients rostered within each physician group (FPT vs FPNT). Patient demographic characteristics included age, sex, neighbourhood income quintile (NIQ) (NIQ 1= 0-20%, NIQ 2= 20-40%, NIQ 3= 40-60%, NIQ 4= 60-80%, NIQ 5= 80%+), and whether they live in a rural or urban area. Patient utilization and medical complexity were considered within each annual cross-section by assessing: number of primary care provider visits (total, mental health and non-mental health); number of emergency department visits (total, mental health and non-mental health-related); number of hospitalizations (total, mental health and non-mental health-related); and comorbidities using the Johns Hopkins' Aggregated Diagnosis Groups (ADG). Mental health primary care visits were defined using a validated algorithm to identify adults accessing care for a mental health disorder, which included adult mental health diagnostic codes 295-298, 300-304, 306, 309, 311, 897-902, 904, 905 (which represents a broad range of adult mental health and addiction diagnoses as defined by the International Classification of Diseases 10 (ICD-10-CA)).~~Mental health primary care visits were defined using a validated algorithm, and included mental health diagnostic codes 295-298, 300-304, 306, 309, 311, 897-902, 904, 905.~~[37] Hospitalizations and ED visits included ~~International Classification of Diseases 10 (~~ICD-10-CA~~)~~ codes F04-F99 (which excludes dementia). The Johns Hopkins ADG's are categorized based on five clinical dimensions, including the duration, the severity, the etiology, the diagnostic certainty and the specialty care

involvement of the condition. ~~Study subjects may have diagnoses ranging between 0-32 ADGs.~~[38]

Analysis

Descriptive Analysis

Annual Outputs and Trends over Time

Annual panels containing physician and patient characteristics were described, including counts, column percentages, and means with standard deviations. Additionally, changes over time were evaluated for each of the physician characteristics ~~to assess if there were changing trends in physicians using telepsychiatry throughout our study period~~.

Matched Physician Comparison

~~A one year (FY 2016) comparison of FPTs vs FPNTs to compare between-group differences was conducted by matching (1:2) based on the fourteen LHINs (the region in which they worked).~~ Matched comparisons between FTPs and FTNPs were presented as counts, column percentages, and standardized mean differences (SMD). We compared between-group differences using the standard mean difference (SMD). Cohen (1988) suggests a small effect size is equal to 0.2 SMD, but recent studies suggest that a more prudent threshold for assessing effect size is 0.1 SMD, especially with large data sets.[39,40] Using this threshold (0.1 SMD), this study identifies significant differences between groups.

The model covariates included physician age (categorical; <34, 35-44, 45-54, 55-64, 64+), sex (Male/Female), number of years after graduation (categorical; 1-10, 11-20, 21-30, 31-40, 41+ years), rural residence (living in community with less than 10,000 people- Yes/No), total nurse practitioner on the team (continuous), total social workers on the team (continuous), if the family physician is a Canadian Medical Graduate (Yes/No), the physician practice type (FHT/Other), patient age (categorical; 0-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81+ years), patient sex (Male/Female), patient NIQ (categorical; 1-5), if the FP has more patients in low NIQ areas (Yes/No), patient residence (Urban/Rural), if the FP has more urban patients than rural (Yes/No), if the FP has more patients with at least one psychosocial ADG (Yes/No), patient region (categorical; LHIN1-14), total number of ED visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+), total number of mental health ED visits (categorical;0-3, 4-9, 10-19, 20+ visits), total hospitalizations (categorical; 0, 1-2, 3-5, 6-10, 11+), total mental health hospitalizations (categorical; 0, 1-2, 3-5, 6-10, 11+), total primary care visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+) and total mental health primary care provider visits (categorical; 0-59, 60-156, 157-257, 258-414, 415+).

Statistical Analysis

We used statistical modeling to understand the predictors of referring to telepsychiatry among physicians. We used GEE for the statistical model, as it accounts for patient clustering at the provider level.[41] ~~The outcome variable was a referral to telepsychiatry (Yes/No) and the covariates are the same as those described in the comparison above, however, whether they were part of a family health team or not, and number of nurse~~

practitioner variables were removed, as they were enveloped within the cluster and thus would have been considered co-linear. All analyses were carried out using SAS version 9.4 (SAS Institute, Cary, NC). All results were presented as adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs).

Results

Descriptive analysis of FTPs

Our study compared the difference between FTPs and FPNTs, using descriptive and statistical analyses. In FY 2016, there were 13,290 family physicians in Ontario; this analysis includes a subset of those family physicians who have referred to telepsychiatry.[42]

Increase in Patients Accessing and Family Physicians Referring to Telepsychiatry

The number of patients receiving telepsychiatry increased from 925 patients in FY 2008 to 13,825 patients in FY 2016, which represents approximately a fifteen-fold increase (see Table 1). There was also substantial growth in the number of FPTs from 474 to 4,224, which represents a nine-fold increase from FY 2008 to FY 2016 (see Table 1). Of all physicians in Ontario, 32% referred to telepsychiatry in FY 2016 (4224/13290). Less than 1% of total patients rostered to FPTs had a telepsychiatry visit in FY 2018 (n= 12,449/3,513,638). [Insert Figure 1]

Physician Rurality

In FY 2008, the percentage of total telepsychiatry visits was highest in the North East LHIN (20%, n = 94), followed by the North West LHIN (16%, n = 74) (Ontario's most northern regions), followed by the South West LHIN (15%, n = 70). In FY 2016, those numbers shifted so ~~that~~ the highest percentage of telepsychiatry referrals came from family physicians in ~~more central~~ regions such as Hamilton Niagara Haldimand Brant (10%, n = 433), Central East (10%, n = 421), and Toronto Central (10%, n = 420) LHINs, with the Central (n = 393) and North East (n = 379) LHIN's family physicians referring 9% each. All LHINs ranged between 4-10% of total telepsychiatry delivery in FY 2016, compared to FY 2008, where the range spread from 0% (in Mississauga Halton LHIN) to 20% (in the North East LHIN). This shows a more evenly distributed adoption of telepsychiatry from ~~strictly~~ \northern regions to all regions of Ontario, many of which still have highly rural and remote communities. [Insert Figure 2]

Comparative Analysis

Family Physician Characteristics

A larger percentage of FPTs were male, compared to FPNTs (59.6% (n = 2427) vs. 53.1% (n = 4075), SD = 0.13). A greater percentage of FPTs were from communities with a population that had less than 10,000 people (14.9% (n = 608) vs. 8.2% (n = 633), SMD = 0.21). FPTs had a larger mean number of nurse practitioners and FPNTs (1.71 (+/- 4.02) vs. 1.10 (+/- 3.70), SMD =0.16), finally, a greater percentage of FPTs

belonged to FHTs than FPNTs (28.1% (n = 1145) vs. 18% (n = 1381), SMD = 0.24).

[Insert Table 1]

Comparing Patient Roster Characteristics

There were a few notable differences in patient roster characteristics between FPTs and FPNTs. FPTs had a larger mean number of attached patients than FPNTs (862.45 (+/- 668.36) vs. 788.97 (+/- 605.70), SMD = 0.15). A greater percentage of FPTs had patients on their roster from lower NIQ's than FPNTs (1-3) (77.7% (n = 3167) vs. 69.8% (n = 5353), SMD = 0.18). FPTs had a larger mean number of patients from a rural residence compared to FPNTs (139.28 (+/- 256.05) vs. 54.93 (+/- 137.27), SMD = 0.41). A greater percentage of FPTs had more patients from rural areas than urban areas (14.6% (N = 594) vs. 6.8% (n = 522), SMD = 0.25). FPNTs had a higher patient mean in the Champlain LHIN (which includes Ottawa, a~~n~~ large urban region in Ontario) (FPT = 61.94 (+/- 236.36), FPTN = 99.43 (+/-287.94), SMD = 0.14). FPTs had higher patient means in four LHINs (mostly northern regions): South East (SE) LHIN (FPT = 47.03 (+/- 209), FPTN = 24.27 (+/-132.92), SMD = 0.13), North Simcoe Muskoka (NSM) LHIN (FPT = 59.28 (+/- 230.38), FPNT = 15.12 (+/- 97.56), SMD =0.25), North East (NE) LHIN (FPT = 53.59 (+/- 228.57), FPNT = 19.86 (+/- 124.20), SMD =0.18), North West (NW) LHIN (FPT = 24.64 (+/- 149.32), FPNT = 6.06 (+/- 101.30), SMD = 0.16).

The mean number of patients with psychosocial ADG's was higher for FPTs compared to FPNTs (258.24 (+/- 204.4) vs. 217.56 (+/- 179.29), SMD = 0.21).The mean mental health primary care provider (MHPCP) visits was higher in FPTs compared to FPNTs

(707.60 (+/- 2863.95) vs. 276.86 (+/- 532.56), SMD = 0.21). Due to the large standard deviation, we also examined the median for MHPCP; FPTs had a higher median MHPCP visits than FPNTs (229 (IQR=106-415) vs. 189 (IQR=110-350), SMD = 0.24). FPTs have a higher percentage of patients with 415+ MHPCP visits compared to FPNTs (25.2% (n = 1026) vs. 16.7% (n = 1285), SMD 0.21).

The mean number of ED visits was ~~significantly~~ higher for FPTs compared to FPTNs (440.82 (+/- 357.7) vs. 291.96 (+/- 240.01), SMD = 0.49). Table 1 describes the difference between all categories, but the most notable differences are for patients that had 60-156, 157-257, and 415+ visits. FPTs had a lower percentage of patients with 60-156 ED visits than FPNTs (9.5% (n = 387) vs. 17.2% (n = 1320), SMD = 0.23) and patients with 157-257 visits (12.0% (n = 489) vs. 19.5% (n = 1495), SMD = 0.21). FPTs has a greater percentage of patients with 415+ ED visits compared to FPNTs (45.6% (n = 1857) vs. 16.7% (n = 1285), SMD = 0.48).

FPTs had a larger mean number of MHED visits for rostered patients compared to FPNTs (18.99 (+/- 29.07) vs. 10.91 (+/- 13.07), SMD = 0.36). Full details within each category are in Table 1, but the most notable difference was the group that had 0-3 and 20+ MHED visits. FPTs had a lower percentage of patients with 0-3 MHED visits than FPNTs (16.7% (n = 681) vs. 27.5% (n = 2108), SMD = 0.26) and a higher percentage of patients with 20+ MHED visits than FPNTs (30.9% (n = 1258) vs. 14.1% (n = 1084), SMD = 0.41).

FPTs had a greater mean of hospitalizations compared to FPNTs (57.05 (+/-47.43) vs. 10.91 (+/-13.07), SMD = 0.36). Full details within each category are in Table 1, but the most notable difference was that FPTs had a larger percentage of patients with 11+ hospitalizations, compared to FPNTs (85.7% (n = 3491) vs. 78.8% (n = 6044), SMD = 0.18). Of those hospitalizations, mental health specific hospitalizations (MHH) were measured. FPTs had a greater mean of MHH visits compared to FPNTs (7.01 (+/-13.61) vs. 3.86 (+/-5.43), SMD = 0.36). The most striking differences were the groups that had zero visits and those with 11+ visits. FPTs had a lower percentage of patients with zero MHH visits compared to FPNTs (13.4% (n = 545) vs. 21.9% (n = 1679), SMD = 0.22). FPTs had a higher percentage of patients with 11+ MHH visits compared to FPNTs (17.8% (n = 725) vs. 6.8% (n = 518), SMD = 0.34).

Statistical Modeling

Regression using Generalized Estimating Equations

A full description of the findings is listed in Table 2. Within this model, a number of significant correlates of FPTs were identified, including physician age group of 55-64 (OR=0.85, CI=00.74-0.97), physician age group of 64+ (OR=0.85, CI=0.62-0.85), and FPTs were more likely to be located in rural areas (OR=1.38, CI=1.17-1.62). Compared to patient rosters of FPNTs, FPT rostered patients were: almost half as likely to be urban (OR=0.55, CI=0.43-.70), more likely to have psychiatric ADGs (OR=1.2, CI=0.86-1.66), and more likely to have 4-9 mental health ED (MHED) visits (OR=1.33, CI=1.03-1.72), patients with 10-19 MHED visits (OR=1.54 CI=1.14-2.07), patients with 20+

MHED visits (OR=2.17, CI=1.60-2.94), patients with 3-5 MHH (OR=1.21, CI=1.08-1.35), patients with 6-10 MHH (OR=1.32, CI=1.15-1.51), patients with 11+ MHH (OR=1.77, CI=1.28-2.43), patients with 157-257 mental health primary care (MHPC) visits (OR=1.24, CI=1.00-1.54), patients with 258-414 MHPC visits (OR=1.38 CI=1.09-1.76), patients with 415+ MHPC visits (OR=1.61, CI=01.33-1.94). [Insert Table 2].

Discussion

To our knowledge, this is the first study that investigates trends and predictors of family physicians referring to telepsychiatry at a system-level. Between FY 2008 and FY 2016, there was a 9-fold increase in the number of primary care physicians referring to telepsychiatry and a nearly 15-fold increase in the number of primary care patients referred to telepsychiatry. 32% of family physicians referred to telepsychiatry, while less than 1% of patients rostered to FPTs utilized telepsychiatry. While patient adoption of telepsychiatry continued to increase in Ontario during the study period, it still represents a very small percentage of patients in Ontario. These visits represent, for the most part, patients that ~~are~~were required to go to a healthcare site to access care and psychiatrists that are required to use the ~~OTN~~provincial telemedicine platform. It is evident that there remains a large opportunity to increase patient adoption. ~~As reported elsewhere, in 2012, only about 7% of psychiatrists were providing telepsychiatry visits, so similar to patients, there is still significant adoption potential for psychiatrists.[27]~~ As discussed in the introduction, it is likely that the recent Covid-19 related temporary policy changes to virtual care ~~might~~will present an opportunity for significant growth and adoption of

telepsychiatry. This study ~~can~~ provides an essential benchmark for future analyses, comparing how these policy changes have ~~changed~~shifted adoption patterns with patients and family physician referrals.

Physicians who referred to telepsychiatry in FY 2008 were mainly from northern regions ~~(LHINs) of the province~~, whereas in FY 2016, more referrals from southern regions ~~(LHINs)~~ emerged, many of which still have rural ~~pockets~~ areas within their catchments. Referral to telepsychiatry was ~~much~~ more evenly distributed throughout the province in FY 2016. ~~In FY 2016 physicians from all LHINs referred somewhere between 4-10% of total telepsychiatry, compared to FY 2008 where the range spread from 0% to 20%, with six LHINs that delivered more than 9% of total telepsychiatry each and eight LHINs all delivering less than 4% each.~~ While historically telepsychiatry was used to support rural populations, in later years of the study, there were increasing provincially funded ~~'urban'~~ telepsychiatry projects that aimed to increase adoption of telepsychiatry within ~~urban~~more populous regions. While it i~~'~~s important to create access and choice for patients in both rural and urban areas~~, and increase access provincially.~~, policy-makers and funders should consider ~~how existing payment and funding models support prioritization of care to underserved populations, and might consider strategies such as a wait-times dashboard to help better distribute care virtually.~~ aspects of digital health equity[43], allowing the use of diverse secure virtual platforms, funding home-based visits and establishing mechanisms to support the appropriate distribution of virtual care throughout the province.

Past studies have suggested that physicians who were more isolated and were part of an integrated health system had positive feelings about telemedicine, and that nurses were more enthusiastic about telemedicine than physicians.[25,36] As such, unperhaps not surprisingly, this study found that predictors of family physician referrals to telepsychiatry include rurality of residence (for both provider and patient), team-based practice models, having more nurse practitioners on the team, and clinical complexity of patient rosters, and if referring the provider was part of a family health team. . Additionally, FPTs were more likely to have rostered patients who had more clinical complexity and higher healthcare utilization rates. While this might be an indicator of patients' overall complexity, the number of people accessing mental health care in the ED can also be an indicator of a lack of access to outpatient mental health care. As access to telepsychiatry continues to increase, studies measuring potential diversion from ED-related mental health visits would be helpful.

This study has numerous strengths; it utilizes a large, multi-year, linked dataset of family physician and patient data to help understand important characteristics that are common in physicians who refer to telepsychiatry. Additionally, since this study uses administrative data, the study was conducted rapidly using a retrospective analysis. However, tThis study also has several limitations. The identification of telepsychiatry visits is contingent upon psychiatrists using telepsychiatry billing codes and billing fee for service, so it is possible that there is missing data, or an underrepresentation of visits completed by physicians paid by salary or alternate funding. Another potential

limitation, is that while this study includes nurse practitioners as a covariate in the analysis, it does not take into account actual nurse practitioner referrals to telepsychiatry, which could lead to an underestimate of our total telepsychiatry visits. We believe, however, that this will have minimal impact on our study because it is likely that nurse practitioner referrals will be captured within total telepsychiatry visits, but rostered (as defined in our methods) to a family physician instead.

Conclusion

~~Over the study period, the number of patients receiving and providers referring to telepsychiatry has increased by fifteen-fold and nine-fold,~~While telepsychiatry has seen continued growth over recent years, ~~respectively~~there remains significant opportunities for increased adoption. This study shows that certain factors, including rurality, provider practice type, the number of nurse practitioners on the provider's team, as well as patient healthcare and hospital utilization characteristics are more likely in FPTs than FPNTs. This study provides a baseline from which to assess recent rapid mobilization of telepsychiatry, and a means of doing so using administrative health data.

Tables and Figures

Figure 1. Telepsychiatry Adoption by Year (FY2008 and FY2016)

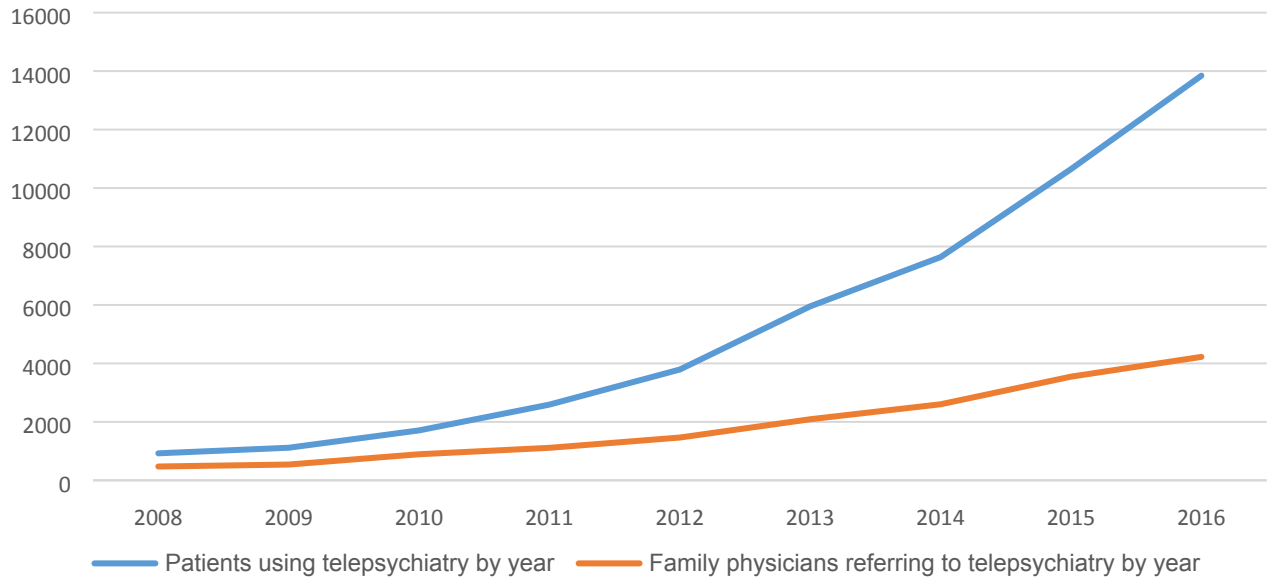

Figure 2. Percentage of Referring Physicians by Region (2008 and 2016)

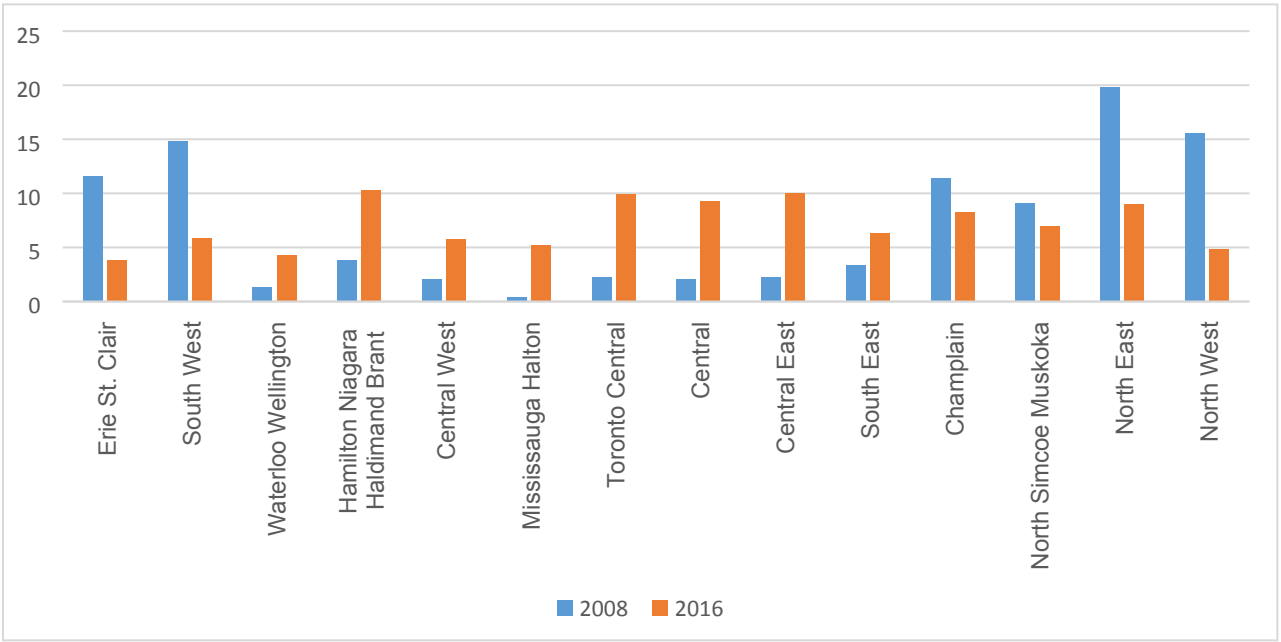

Table **1**. Comparative Analysis of Family Physicians that Refer to Telepsychiatry compared to (2016)

VARIABLE	VALUE	FPT	FPNT	TOTAL	SMD
		N = 4,074	N = 7,674	N = 11,748	
PHYSICIAN CHARACTERISTICS					
Physician Sex	F	1,647 (40.4%)	3,599 (46.9%)	5,246 (44.7%)	0.13
	M	2,427 (59.6%)	4,075 (53.1%)	6,502 (55.3%)	0.13
< 10,000 population in CMA	N	3,466 (85.1%)	7,041 (91.8%)	10,507 (89.4%)	0.21
	Y	608 (14.9%)	633 (8.2%)	1,241 (10.6%)	0.21
Nurse Practitioners on Team	Mean ± SD	1.71 ± 4.02	1.10 ± 3.70	1.31 ± 3.83	0.16
Physician Practice Type	FHT	1,145 (28.1%)	1,381 (18.0%)	2,526 (21.5%)	0.24
	Others	2,929 (71.9%)	6,293 (82.0%)	9,222 (78.5%)	0.24
PATIENT ROSTER CHARACTERISTICS					
Total # of attached patients	Mean ± SD	862.45 ± 668.36	766.97 ± 605.70	800.64 ± 630.13	0.15
# patients in NIQ 1,2&3 > # patients in NIQ 4&5	No	907 (22.3%)	2,127 (27.7%)	3,034 (25.8%)	0.13
	Yes	3,167 (77.7%)	5,353 (69.8%)	8,520 (72.5%)	0.18
Rural Residence	Mean ± SD	139.28 ± 256.05	54.93 ± 137.27	84.67 ± 192.19	0.41
# of patients in urban residence > # of patients in rural residence	No	594 (14.6%)	522 (6.8%)	1,116 (9.5%)	0.25
	Yes	3,480 (85.4%)	6,958 (90.7%)	10,438 (88.8%)	0.16
South East LHIN	Mean ± SD	47.03 ± 209.09	24.27 ± 132.92	32.29 ± 164.22	0.13
Champlain LHIN	Mean ± SD	61.94 ± 263.36	99.43 ± 287.94	86.21 ± 280.09	0.14
North Simcoe Muskoka LHIN	Mean ± SD	59.28 ± 230.38	15.12 ± 97.56	30.69 ± 159.11	0.25
North East LHIN	Mean ± SD	53.59 ± 228.57	19.86 ± 124.20	31.75 ± 169.31	0.18
North West LHIN	Mean ± SD	24.64 ± 149.32	6.06 ± 59.90	12.61 ± 101.30	0.16
# of patients with a psychosocial ADG	Mean ± SD	258.24 ± 204.40	217.56 ± 179.29	231.91 ± 189.52	0.21
Total MH PCP visits	Mean ± SD	707.60 ± 2,863.95	276.86 ± 532.56	428.74 ± 1,765.68	0.21
	Median (IQR)	239 (106-415)	188 (73-335)	204 (82-364)	0.24
	00-59	686 (16.8%)	1,626 (21.2%)	2,312 (19.7%)	0.11
	60-156	702 (17.2%)	1,612 (21.0%)	2,314 (19.7%)	0.1
	157-257	795 (19.5%)	1,512 (19.7%)	2,307 (19.6%)	0

	258-414	865 (21.2%)	1,445 (18.8%)	2,310 (19.7%)	0.06
	415-high	1,026 (25.2%)	1,285 (16.7%)	2,311 (19.7%)	0.21
VARIABLE	**VALUE**	**FPT**	**FPNT**	**TOTAL**	**SMD**
Total ED visits	Mean ± SD	440.82 ± 357.70	291.96 ± 240.01	344.45 ± 295.74	0.49
	00-59	493 (12.1%)	1,090 (14.2%)	1,583 (13.5%)	0.06
	60-156	387 (9.5%)	1,320 (17.2%)	1,707 (14.5%)	0.23
	157-257	489 (12.0%)	1,495 (19.5%)	1,984 (16.9%)	0.21
	258-414	848 (20.8%)	1,782 (23.2%)	2,630 (22.4%)	0.06
	415-high	1,857 (45.6%)	1,793 (23.4%)	3,650 (31.1%)	0.48
Total MH ED visits	Mean ± SD	18.99 ± 29.07	10.91 ± 13.07	13.75 ± 20.58	0.36
	00-03	681 (16.7%)	2,108 (27.5%)	2,789 (23.7%)	0.26
	04-09	922 (22.6%)	2,275 (29.6%)	3,197 (27.2%)	0.16
	10-19	1,213 (29.8%)	2,013 (26.2%)	3,226 (27.5%)	0.08
	20-high	1,258 (30.9%)	1,084 (14.1%)	2,342 (19.9%)	0.41
Total hospitalizations	Mean ± SD	57.05 ± 47.43	41.75 ± 36.01	47.15 ± 41.06	0.36
	0 visits	116 (2.8%)	286 (3.7%)	402 (3.4%)	0.05
	01-02 visit	133 (3.3%)	287 (3.7%)	420 (3.6%)	0.03
	03-05 visits	131 (3.2%)	374 (4.9%)	505 (4.3%)	0.08
	06-10 visits	203 (5.0%)	489 (6.4%)	692 (5.9%)	0.06
	11+ visits	3,491 (85.7%)	6,044 (78.8%)	9,535 (81.2%)	0.18
Total MH hospitalizations	Mean ± SD	7.01 ± 13.61	3.86 ± 5.43	4.97 ± 9.31	0.3
	0 visits	545 (13.4%)	1,679 (21.9%)	2,224 (18.9%)	0.22
	01-02 visit	768 (18.9%)	2,078 (27.1%)	2,846 (24.2%)	0.2
	03-05 visits	1,072 (26.3%)	1,959 (25.5%)	3,031 (25.8%)	0.02
	06-10 visits	964 (23.7%)	1,246 (16.2%)	2,210 (18.8%)	0.19
	11+ visits	725 (17.8%)	518 (6.8%)	1,243 (10.6%)	0.34

NIQ= Neighbourhood Income Quintiles
LHIN=Local Health Integration Networks
ADG= Aggregated Diagnosis Groupings
MHPCP= Mental Health Primary Care Practitioner
ED= Emergency Department
MH ED= Mental Health Emergency Department
MH= Mental Health

Table 2. Model using Generalized Estimating Equations comparing FPTs vs FPNTs (2016)

Analysis Of GEE Parameter Estimates			
	Estimate	95% Confidence Limits	
Intercept	-0.9162	-1.1901	-0.6423
Physician Age 35-44 vs <=34	0.8895	0.7855	1.0072
Physician Age 45-54 vs <=34	0.9082	0.7983	1.0333
Physician Age 55-64 vs <=34	0.849	0.7419	0.9717
Physician Age 64+ vs <=34	0.7255	0.6223	0.8458
Sex (Male vs Female)	1.0144	0.9368	1.0983
Physician Rural (Yes vs No)	1.3791	1.174	1.6199
Canadian Medical Graduate (Yes vs No)	1.0333	0.9493	1.1247
Canadian Medical Graduate (Unknown vs No)	1.0231	0.8617	1.2148
More patients in low/med income quintile (Yes vs No)	1.0719	0.969	1.1856
More urban patients (Yes vs No)	0.5491	0.4338	0.6952
Mental Health ED Visits (04-09 vs 00-03)	1.3289	1.0252	1.7226
Mental Health ED Visits (10-19 vs 00-03)	1.5373	1.1442	2.0654
Mental Health ED Visits (20-high vs 00-03)	2.1678	1.601	2.9352
Mental Health Hospitalizations (0 visits vs 01-02 visit)	0.9072	0.7363	1.1179
Mental Health Hospitalizations 03-05 visits vs 01-02 visit	1.2048	1.0749	1.3504
Mental Health Hospitalizations 06-10 visits vs 01-02 visit	1.316	1.1496	1.5064
Mental Health Hospitalizations 11+ visits vs 01-02 visit	1.7662	1.2837	2.4301
Mental Health Primary Care Visits (60-156 vs 00-59)	0.965	0.8134	1.1449
Mental Health Primary Care Visits (157-257 vs 00-59)	1.237	0.9943	1.539
Mental Health Primary Care Visits (258-414 vs 00-59)	1.384	1.0859	1.7638
Mental Health Primary Care Visits (415-high vs 00-59)	1.6089	1.3322	1.943
More patients with psychiatric ADGs (Yes vs No)	1.1979	0.8627	1.6634

ED= Emergency Department

ADG= Aggregated Diagnosis Groups

References

1. Brien S, Grenier L, Kapral M. *Taking stock.* Health Quality Ontario; 2015.

2. Bishop TF, Press MJ, Keyhani S, Pincus HA. Acceptance of insurance by psychiatrists and the implications for access to mental health care. *JAMA psychiatry*. 2014;71(2):176-181.

3. World Health Organization. Mental disorders affect one in four people. *World Health Report*. 2001.

4. Alegría M, Nakash O, NeMoyer A. Increasing equity in access to mental health care: A critical first step in improving service quality. *World Psychiatry*. 2018;17(1):43.

5. Wang PS, Aguilar-Gaxiola S, Alonso J, et al. Use of mental health services for anxiety, mood, and substance disorders in 17 countries in the WHO world mental health surveys. *The Lancet*. 2007;370(9590):841-850.

6. Goldner EM, Jones W, Fang ML. Access to and waiting time for psychiatrist services in a canadian urban area: A study in real time. *The Canadian Journal of Psychiatry*. 2011;56(8):474-480.

7. Meadows GN, Enticott JC, Inder B, Russell GM, Gurr R. Better access to mental health care and the failure of the medicare principle of universality. *Med J Aust*. 2015;202(4):190-194.

8. Cunningham PJ. Beyond parity: Primary care physicians' perspectives on access to mental health care: More PCPs have trouble obtaining mental health services for their patients than have problems getting other specialty services. *Health Aff*. 2009;28(Suppl1):w490-w501.

9. Kurdyak P, Zaheer J, Cheng J, Rudoler D, Mulsant BH. Changes in characteristics and practice patterns of ontario psychiatrists: Implications for access to psychiatrists. *The Canadian Journal of Psychiatry*. 2017;62(1):40-47.

10. Kurdyak P, Stukel TA, Goldbloom D, Kopp A, Zagorski BM, Mulsant BH. Universal coverage without universal access: A study of psychiatrist supply and practice patterns in ontario. *Open Medicine*. 2014;8(3):e87.

11. Myers KM, Valentine JM, Melzer SM. Child and adolescent telepsychiatry: Utilization and satisfaction. *Telemedicine and e-Health*. 2008;14(2):131-137.

12. Antonacci DJ, Bloch RM, Saeed SA, Yildirim Y, Talley J. Empirical evidence on the use and effectiveness of telepsychiatry via videoconferencing: Implications for forensic and correctional psychiatry. *Behav Sci Law*. 2008;26(3):253-269.

13. Campbell R, O'Gorman J, Cernovsky ZZ. Reactions of psychiatric patients to telepsychiatry. *Mental illness*. 2015;7(2).

14. Deslich S, Stec B, Tomblin S, Coustasse A. Telepsychiatry in the 21st century: Transforming healthcare with technology. *Perspectives in Health Information*

Management/AHIMA, American Health Information Management Association. 2013;10(Summer).

15. Fleming DA, Edison KE, Pak H. Telehealth ethics. *Telemedicine and e-Health*. 2009;15(8):797-803.

16. Saeed SA, Diamond J, Bloch RM. Use of telepsychiatry to improve care for people with mental illness in rural North Carolina. *NC Med J*. 2011;72(3):219-222.

17. Ulzen T, Williamson L, Foster PP, Parris-Barnes K. The evolution of a community-based telepsychiatry program in rural alabama: Lessons learned—a brief report. *Community Ment Health J*. 2013;49(1):101-105.

18. Lyketsos CG, Roques C, Hovanec L, Jones III BN. Telemedicine use and the reduction of psychiatric admissions from a long-term care facility. *J Geriatr Psychiatry Neurol*. 2001;14(2):76-79.

19. Hilty DM, Ferrer DC, Parish MB, Johnston B, Callahan EJ, Yellowlees PM. The effectiveness of telemental health: A 2013 review. *Telemedicine and e-Health*. 2013;19(6):444-454.

20. Chakrabarti S. Usefulness of telepsychiatry: A critical evaluation of videoconferencing-based approaches. *World journal of psychiatry*. 2015;5(3):286.

21. Bishop JE, O'Reilly RL, Maddox K, Hutchinson LJ. Client satisfaction in a feasibility study comparing face-to-face interviews with telepsychiatry. *J Telemed Telecare*. 2002;8(4):217-221.

22. Frueh BC, Monnier J, Yim E, Grubaugh AL, Hamner MB, Knapp RG. A randomized trial of telepsychiatry for post-traumatic stress disorder. *J Telemed Telecare*. 2007;13(3):142-147.

23. Farabee D, Calhoun S, Veliz R. An experimental comparison of telepsychiatry and conventional psychiatry for parolees. *Psychiatric Services*. 2016;67(5):562-565.

24. Bashshur RL, Shannon GW, Bashshur N, Yellowlees PM. The empirical evidence for telemedicine interventions in mental disorders. *Telemedicine and e-Health*. 2016;22(2):87-113.

25. Sargeant J, Allen M, Langille D. Physician perceptions of the effect of telemedicine on rural retention and recruitment. *J Telemed Telecare*. 2004;10(2):89-93.

26. Swanson B. Information technology and under-served communities. *J Telemed Telecare*. 1999;5(2_suppl):3-10.

27. Serhal E, Crawford A, Cheng J, Kurdyak P. Implementation and utilisation of telepsychiatry in Ontario: A population-based study. *The Canadian Journal of Psychiatry*. 2017;62(10):716-725.

28. Grumbach K, Selby JV, Damberg C, et al. Resolving the gatekeeper conundrum: What patients value in primary care and referrals to specialists. *JAMA*. 1999;282(3):261-266.

29. Norton PG, Dunn EV, Bestvater D. Referrals in primary care: Is the family physician a “Gatekeeper”? *Canadian Family Physician*. 1989;35:1776.

30. Steele M, Zayed R, Davidson B, et al. Referral patterns and training needs in psychiatry among primary care physicians in canadian rural/remote areas. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*. 2012;21(2):111.

31. Spaulding RJ, Russo T, Cook DJ, Doolittle GC. Diffusion theory and telemedicine adoption by kansas health-care providers: Critical factors in telemedicine adoption for improved patient access. *J Telemed Telecare*. 2005;11(1_suppl):107-109.

32. Whitten P, Franken EA. Telemedicine for patient consultation: Factors affecting use by rural primary-care physicians in kansas. *J Telemed Telecare*. 1995;1(3):139-144.

33. LeRouge C, Garfield M. Crossing the telemedicine chasm: Have the US barriers to widespread adoption of telemedicine been significantly reduced? *International journal of environmental research and public health*. 2013;10(12):6472-6484.

34. Moore MA, Coffman M, Jetty A, Klink K, Petterson S, Bazemore A. Family physicians report considerable interest in, but limited use of, telehealth services. *The Journal of the American Board of Family Medicine*. 2017;30(3):320-330.

35. Spaulding R, Cain S, Sonnenschein K. Urban telepsychiatry: Uncommon service for a common need. *Child and Adolescent Psychiatric Clinics*. 2011;20(1):29-39.

36. Whitten PS, Mackert MS. Addressing telehealth's foremost barrier: Provider as initial gatekeeper. *Int J Technol Assess Health Care*. 2005;21(4):517-521.

37. Steele LS, Glazier RH, Lin E, Evans M. Using administrative data to measure ambulatory mental health service provision in primary care. *Med Care*. 2004:960-965.

38. Austin PC, van Walraven C, Wodchis WP, Newman A, Anderson GM. Using the Johns Hopkins aggregated diagnosis groups (ADGs) to predict mortality in a general adult population cohort in Ontario, Canada. *Med Care*. 2011;49(10):932.

39. Cohen J. *Statistical power analysis for the behavioral sciences.* Routledge; 2013.

40. Austin PC. Using the standardized difference to compare the prevalence of a binary variable between two groups in observational research. *Communications in Statistics-Simulation and Computation*. 2009;38(6):1228-1234.

41. Wang M. Generalized estimating equations in longitudinal data analysis: A review and recent developments. *Advances in Statistics*. 2014;2014.

42. The Ontario Physician Human Resources Data Centre. . (2018, 10). Physicians in Ontario 2017. Retrieved from the Ontario Physician Human Resources data centre: Http://Www.ophrdc.org/wp-content/uploads/2018/10/PIO-2017-report-with-hyperlinks.pdf. Mc*Master University*. 2018.

43. Crawford, A., & Serhal, E. (2020). Digital Health Equity and COVID-19: The Innovation Curve Cannot Reinforce the Social Gradient of Health. Journal of Medical Internet Research, 22(6), e19361.